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187

## Mining for Power

By F. H. Mason

## Selection and Application of Wire-Rope Lubricant

By C. D. Meals

## Prospecting and Valuing a Lead-Zinc Deposit

By William F. Netzeband

## Analyzing the Cost of Copper Production

By A. B. Parsons



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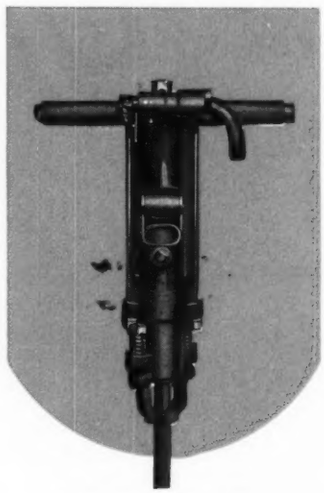

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*Assistant Editors:* W. N. P. REED, H. D. KEISER and HOMAR L. JOHNSON, New York. *Publishing Director:* H. W. CLARKE

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## The Anaconda Issue
## August Tenth

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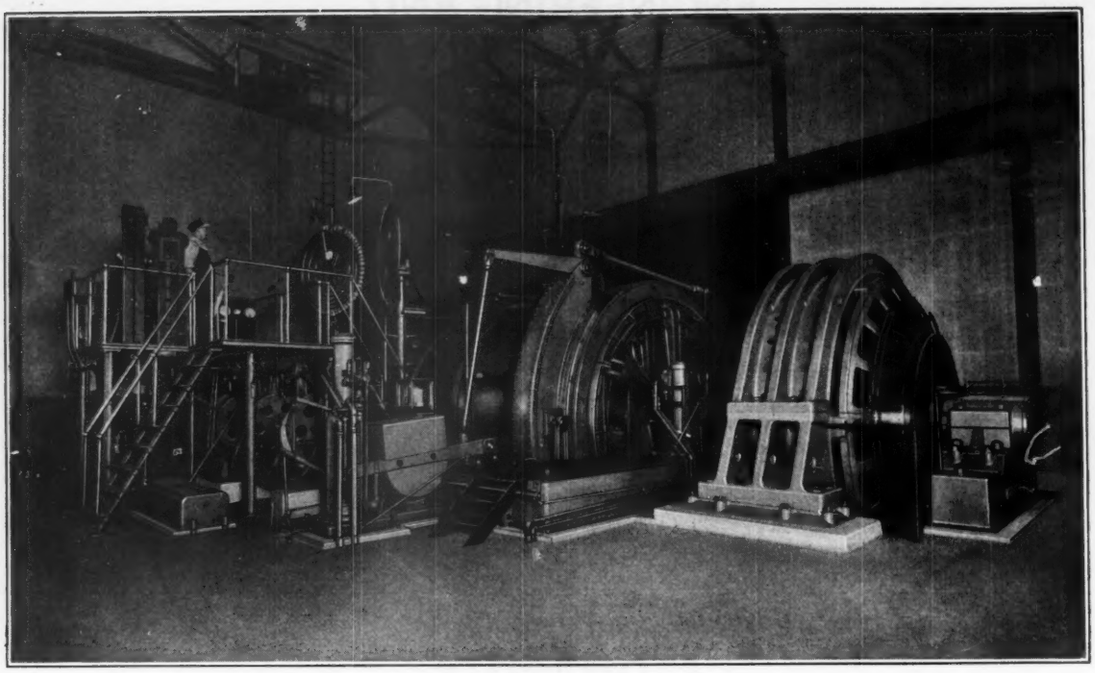

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# MINING JOURNAL

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H. W. CLARKE,
*Publishing Director*

VOLUME 127 — *New York, June 8, 1929* — NUMBER 23

## Mining Industry Joins in Honoring Thomas A. Edison

"WITH THE SEMI-CENTENNIAL of the incandescent electric light, Thomas A. Edison, full of years and honors, is again saluted by the industry he founded. In him America sees her most famous citizen, civilization its foremost inventor, humanity its greatest benefactor on the material side. The trainboy, the telegraph operator, the indefatigable experimenter, the veteran of the laboratory, became long ago the peer of all the most illustrious among the moderns. To a world rebellious against the dark, where tallow had been supplanted by kerosene and kerosene by gas, he brought, almost as if by creative edict, the light that all mankind use today—dividing what physicists called indivisable, achieving what scientists termed beyond achievement.

"ONLY FIFTY YEARS AGO—and yet the face of the earth is changed! The unassuming, candid, friendly man, with his capacity for unceasing industry, his power to inspire loyalty, his constitutional skepticism entwined with abiding faith, has wrought a miracle which still persists and grows. Of all the inventions of the last hundred years, his have proved the most fundamental and the most prolific of result.

"EDISON'S TRIUMPH is almost free from derogation and attack. His career is surely among the happiest. It has not been his fate to look back, with contemporary statesmen, on high aims imperfectly achieved, on ambitions largely frustrate, on popularity turned fickle, and to weigh adulation against hatred, success against defeat, reward against neglect, and ask if fame be worth the price. Nor was it his to captain great armies of destruction, 'with their guns and drums,' and then, the cup of victory drained or snatched away, to taste in the throat the acrid tang war leaves behind. Nor yet, with master poets, painters, and musicians, has he had to reflect on the circumscription of artistic eminence and realize to how few the perfect verse, the matchless curve, the ultimate harmony mean aught of enduring or even evanescent delight. Nor, again, has it been his lot to build directly a vast business to respond to his every touch, or to heap together a limitless fortune, and in doing either to incur the onslaughts of envy and calumny or perhaps the accusations of his own conscience at the thought of unfair advantage taken or weaker rivals trampled under foot.

"COLUMBUS EXPIRED IN NEGLECT at fifty-five, unaware that he had found a continent on which the world's last and best hope would be staked. Shakespeare died at fifty-two, little dreaming that his fame would burn with increasing luster as century succeeded century. Lincoln fell at fifty-six, a weary politician, who would have smiled in incredulous scorn had he been told that in sixty years his colossal effigy on the banks of the Potomac would draw his fellow-countrymen as to a shrine. But Edison, descendant of centenarians, lives at eighty-two in the plenitude of acknowledged accomplishment, thousands of mighty turbines hymning his praise, the spillways on innumerable streams and the white ways in uncounted cities proclaiming it, with many millions of human beings consciously grateful to him for toil made lighter, comfort increased, and pleasure enhanced."

Thus writes Mr. F. C. Wells, of the editorial staff of *Electrical World,* in a supplement to that publication recently issued. Other industries in addition to the one Mr. Edison founded should also salute him. Mining has benefited materially from the outcome of his inquisitiveness and simplicity and courage and zeal. So we join with the electrical industry in honoring a great man; and, in so doing, pay tribute to Mr. Wells' literary craftsmanship and sympathetic discernment.

## A New Home for Historical Engineering Equipment

HOW MANY PLANTS possess old equipment that may be considered of historic interest? Most of such machinery has long since been junked, but the junk pile may not have been cleaned up, in which case the new Rosenwald Industrial Museum in Chicago might be glad of a contribution. This exhibit has been provided through an endowment fund of three million dollars given by Julius Rosenwald, and a bond issue of five million dollars voted by the citizens of Chicago for maintenance. It will be housed in the old Fine Arts building in Jackson Park, with office headquarters at 300 West Adams Street.

Though it is unkind to suggest such a thing to our American readers, whose prosperity is largely attributable to a ready willingness to scrap the inefficient machine whenever a saving can be shown by the substitution of a more up-to-date one, it is possible that in some unenlightened mine, mill, or smelter in the country, museum material may actually be in service. In fact, the obsolete has occasionally been seen by some of our roving editors. No excuse can now be offered. If the junk man won't take it, perhaps the Rosenwald Museum will.

Seriously speaking, though, the opportunity thus given to house representative types of engineering equipment is welcome, and the museum will in time no doubt become a most interesting place to visit for those who would enjoy visual evidence of the great strides that have been made in this field.

## Fatal Accident Rate in South Africa Declines as Gold Output Increases

SEVERAL MONTHS AGO the mining world was apprised of a new gold-production record established in 1928 by the mines of the Witwatersrand. Output for the year totaled 10,358,596 ounces, valued at $214,131,187, a gain of 227,966 ounces and $4,712,476 in valuation compared with 1927. Despite many periodic prognostications to the contrary, mining on the Rand, now in its forty-third year, continues on a sound industrial basis. Not only are operations on the scale of those of last year said to be expected in 1929, but further expansion in the industry is also considered probable.

These facts lend impressiveness to the recent announcement of the Transvaal Chamber of Mines to the effect that an accident death rate of 2.29 per 1,000 was achieved in 1928 for a total of 216,500 workers, of which 195,000 were of Negroid stock. This rate is a reduction from that of 2.83 in 1927, and from 3.81 in 1913, when the accident prevention campaign now in operation on the Rand was begun. Similar statistics for the metal-mining industry of the United States compiled by the U. S. Bureau of Mines reveal a fatal accident rate, for a total of 119,699 workers, of 3.10 per 1,000 in 1927, the last year for which such statistics are available.

Many dissimilar factors are involved in accident prevention endeavor as applied on the Rand and in the metal-mining industry of the United States. Obviously, the relative efficacy of the methods employed in the two countries cannot be measured entirely by a comparison of the respective fatal accident rates. Nevertheless, in view of the large number of Negro workers of comparatively low intelligence, and owing to the steadily increasing scale of operations, the achievement of the Witwatersrand mining industry in establishing such an accident rate is particularly praiseworthy. Successful results of this character can be obtained only by consistent and conscientious co-operative effort on the part of a central directing source, various intermediate agencies, and individual workers. Although conditions may vary in different districts, the entire mining industry can benefit from the accomplishments of the Rand in accident prevention. To some degree at least the methods employed there can be applied to advantage elsewhere.

## Helping the Prospector in Alaska

PROSPECTORS in Alaska are greatly handicapped. Only those who have substantial backing can afford to undertake work in that region. By the Prospectors' Aid Act, approved April 25, 1927, Alaskan prospectors are given monetary assistance to meet some of their transportation expenses. Up to Feb. 15, 1929, the total sum disbursed amounted to $18,736.49—a comparatively small amount when the importance of Alaska's mining industry is considered. The discovery of a single good mine in one year or in several years would more than compensate for the outlay.

The administration of the Prospectors' Aid Act seems to be carried out on a liberal basis, and prospectors do not appear to have taken undue advantage of the situation. So far, 149 prospectors have received assistance, and 107 localities have been prospected in about 33 mining precincts. Each prospector is required to submit a written report of the results of the operations for which he receives aid. Fifty reports have been received to date, some of which contain interesting and valuable material. Such a plan, operating over several years, will result in the accumulation of much detailed information about localities far from the well-traveled routes. At least one discovery has been made that seems to be of possible importance, according to the report of Mr. B. D. Stewart, supervising mining engineer.

The method undertaken by Alaska to stimulate mining activity may be criticized, but careful consideration of the situation makes it clear that aid to prospectors is a worth-while experiment that should be continued long enough to obtain an intelligent estimate of its possibilities. The ultimate outcome is almost sure to be successful.

## Should Lawyers or Engineers Solve Technical Questions?

TO THE AVERAGE EASTERNER, Nevada is a state that is distinguished principally for its divorce courts and its frequent but not particularly lucrative gold rushes. Unfortunately, Nevada lawyers do not have to depend solely on divorces for support. Two mining companies—Nevada Consolidated and Consolidated Coppermines—have done much to promote the material welfare of the legal profession and will do still more unless a permanent agreement as to the method of mining their adjoining claims at Ely is reached before a final hearing is held on Nevada's application for an injunction against Coppermines. A gleam of hope that such an agreement may be effected can be obtained from the fact that, when the temporary stipulation to be in effect for the next six months was presented in court, the presiding judge urged the companies to make final settlement of their conflicting claims without recourse to further litigation.

The payment of large sums to lawyers has never extracted a single ton of ore from any known porphyry mine on earth. Needless expense and bad feeling between the officials of the companies involved are usually the only tangible results of litigation over matters in which no moral issue is at stake. Very often, of course, stubbornness and pride on the part of those responsible for determination of operating policies are the most important factors in bringing technical questions to court. To admit that one has made a mistake is always hard, and particularly so when the mistake involves dollars and cents. The co-operation of the best minds of the opposing companies, however, will do much more toward an economical settlement of such questions than any amount of litigation. The court, after all, is bound to decide solely on the legal aspects of the case, and not infrequently these are at variance with sound business policy, or human right.

In the last few years several references have appeared in these columns to the question of arbitration of indus-

trial disputes. In 1927, *Engineering and Mining Journal* pointed out that "It has been noted that the more the arbitration clause is used in contracts, the fewer cases there are to arbitrate." The solution of the problem is to provide for arbitration in every contract. A tremendous psychological difference exists between a legal verdict and an arbitration decision. A verdict of any sort is almost certain to be considered unjust by the losing party in an industrial dispute, whereas an agreement in which both parties have had a hand is undoubtedly acceptable to each. An arbitration clause might well be included in any new contract between Nevada and Coppermines.

## Exploration at Park City Is in Accord With Accepted Principles

AS HAS BEEN REPEATEDLY pointed out in recent years, the era of important discoveries of outcropping orebodies is rapidly nearing an end. Subsurface exploration and the development of mining at greater depths than now practiced appear to offer the only means of meeting in the years ahead the world's steadily increasing need for metals. Numerous difficulties, including mounting costs, are involved in deeper mining, and for these reasons an exploration for non-outcropping deposits would seem the logical method, at least in the immediate future, of substantially adding to the known ore reserves of the world.

Prospecting in new territory, even though situated in a region known to be metalliferous, has not proved to be a generally satisfactory method of finding new orebodies of commercial importance. But, on the contrary, the probability of discovering additional deposits in districts where extensive mining operations are being or have been carried on can be shown by statistics to be excellent. This fact, incidentally, indicates the danger in assuming that a district is worked out or that its ultimate limits have been determined.

In this connection note the attention being given to exploration for new orebodies in the Park City district of Utah, where operations for many years have been almost entirely confined to those of several large and well-known producing companies. Within the last year, and particularly during the last few months, numerous mining interests have undertaken to determine to what extent the metal-bearing area of this long-established silver-lead camp may continue beyond the known and extensively developed ore-producing zones of the district. Smelting interests of the Salt Lake Valley are actively participating in the search. International Smelting controls an area of 6,000 acres in the eastern section; American Smelting & Refining last month acquired 1,000 acres north of Park City; and U. S. Smelting, Refining & Mining has been engaged in furthering development of several properties outside the older portion of the district. In addition to the activity of the smelting companies, more than half a dozen independent and well-financed companies have been organized with the same object in view. Among the officers and directors of these companies appear the names of the leading mining men of the district.

In brief, the area bordering the heretofore established limits of the Park City district is being actively explored by the leading and most competent mining interests of the Salt Lake Valley. Some success has already been achieved, and indications are that substantial additions will be made to known ore reserves. The mining interests which have furnished and are furnishing the geological talent and financial support necessary for this exploration are to be commended.

## The Rise of the American Technical Press

A RESEARCH into the history of the development of the technical press of the United States discloses a paucity of information. According to Marcus Tod, of Oriel College, Oxford, university lecturer in epigraphy, whose article on the subject in the last (1926) edition of the Encyclopedia Britannica makes quaint reading, the earliest scientific publication on this side of the Atlantic was the *Journal of Mineralogy,* founded in 1818. "Since that time," he says, "the *American Journal of Science* has enjoyed unceasing favor. The special periodicals of the day are very numerous. Among the most representative are the *Popular Science Monthly,* New York; the monthly *Boston Journal of Education;* the quarterly *American Journal of Mathematics;* the monthly *Cassier's Magazine* (1891) New York; the monthly *American Engineer* (1893) New York; . . ." and so on. Thus does this authority bring a sense of humility to those responsible for the acceptance of the American technical magazine in the engineering world.

Major progress, however, has occurred in recent years. In 1884 a lengthy report by S. N. D. North was published by the Census Office of the Department of the Interior; and the strictures contained therein may have been responsible for remedial action. "It is natural, under the circumstances," he said, referring to the technical and industrial press, "that in typographical characteristics the special or class journals of Great Britain should, as a rule, be far superior to those of the United States. The art of printing has reached such great perfection in both countries that to command its best results requires only the command of the means. Many of the technical journals of this country are execrably printed, because the use of modern type, good paper and improved machinery is not warranted by the receipts."

Since those days the philosophy of American industry has changed materially. Instead of waiting for an assured income to justify a high quality of product, content with mediocrity meanwhile, the trend has been to invest in the best, in the hope that returns will be adequate to meet the expense. And they always have been. In little over three decades a radical change has taken place, and American technical journalism today for the most part is on a high plane of endeavor. Perhaps its most satisfactory feature, however, is an entire absence of complacency and self-satisfaction. Better work is possible; the ideal is always beyond reach, and constant changes are being effected in the hope of effecting an improvement that will raise the general prosperity of the industry served, in the commercial as well as in the professional branches.

# *Analyzing the Cost of Producing American Copper*

By A. B. PARSONS
*Vice-President, Mineral Research Corporation, New York*

COMPARISON of copper production costs is probably more interesting than profitable, for several reasons. The different companies use methods of accounting in which there is little similarity. Some of them consider an annual report as a necessary but distasteful formality; they reveal as little as possible and in some instances appear to conceal as much as possible. Generally the reason is related to the problem of taxation, though sometimes possible effects on the share market may be a contributing motive. Even among the companies whose reports are reasonably complete, there is wide variation in the methods of grouping and allocating charges. Particularly is this true with items of deferred charges, taxes, interest, general overhead, depreciation, precious metal credits, and sundry miscellaneous income. Moreover, operating conditions and financial positions are so varied that even if all the companies desired to do so, it would be difficult to devise a standard type of financial statement that would be suitable for all.

In respect to Howe Sound, Cerro de Pasco, and in a less degree to Phelps Dodge, it is almost useless to calculate a per-pound-of-copper cost, and for Anaconda the task is hopeless. Yet in spite of this, the compilation in Table I is not without some value to those interested in the copper industry. The data are taken from the annual reports for 1928, all figures being reduced to a per-pound basis on copper *produced*, not sold.

**Table II—Per-Pound Operating Cost After Crediting Sundry Metals**

| | Cents |
|---|---|
| Cerro de Pasco | 2.40 |
| Noranda | 4.84 |
| Chile Copper | 5.42 |
| Howe Sound | 5.43 |
| Andes | 5.88 |
| Utah Copper | 6.20 |
| United Verde Extension | 6.46 |
| Kennecott (including Braden and Utah) | 7.18 |
| Mohawk | 7.35 |
| New Cornelia | 7.42 |
| Magma | 7.66 |
| Calumet & Arizona (new) | 7.79 |
| Calumet & Hecla | 7.98 |
| Kennecott (including Braden) | 8.28 |
| Calumet & Arizona | 8.32 |
| Nevada Consolidated | 8.67 |
| Inspiration | 9.94 |
| Phelps Dodge | 10.40 |
| Mother Lode | 10.54 |
| Granby | 10.81 |
| Miami | 11.10 |
| Copper Range | 14.51 |

So far as actual reported operating cost is concerned, Chile ranks lowest, followed by Andes, Utah, United Verde Extension, and Mohawk, in the order named. Braden probably would be in this group if it were pos-

**Table I—American Copper Mining Companies Production Cost Data for 1928**

Compiled by Mineral Research Corporation, 120 Broadway, New York, N. Y.

*All Figures in Cents per Pound of Copper Produced*

| Company | Production, Millions of Pounds, 1928 | Cumulative Debits: Operating Costs | Cumulative Debits: Plus Taxes and Interest | Cumulative Debits: Plus Depreciation | Cumulative Debits: Plus Depletion | Cumulative Credits: Sundry Metal Income | Cumulative Credits: Plus Miscellaneous Income | Cumulative Credits: Minus Miscellaneous Expense | Cost After Depreciation Before Depletion | Cost After Depreciation and Depletion |
|---|---|---|---|---|---|---|---|---|---|---|
| Andes | 104.1 | 6.29 | 9.80 | 10.33 | .... | 0.41 | 0.64 | .... | 9.69 | .... |
| Calumet & Arizona | 52.4 | 11.30 | 12.59 | 13.51 | .... | 2.98 | (m) 3.93 | 3.68 | 9.[illegible] | .... |
| New Cornelia | 78.0 | 7.98 | 9.44 | 10.03 | .... | 0.56 | 0.73 | .... | 9.20 | .... |
| Calumet & Arizona (new) | 130.3 | 9.32 | 10.70 | 11.42 | .... | 1.53 | 2.02 | 1.91 | 9.51 | .... |
| Calumet & Hecla | 121.2 | 7.98 | (a) 9.35 | 10.78 | 12.80 | .... | 0.26 | 0.11 | 10.67 | 12.69 |
| Copper Range | 24.3 | (b) 14.51 | .... | (c) 15.64 | (c) 17.34 | .... | (2b) 4.68 | (d) 2.54 | 13.10 | 14.80 |
| Cerro de Pasco | 97.7 | 15.20 | 16.06 | (e) 17.87 | (e) 20.58 | (f) 12.80 | 14.18 | .... | 3.69 | 6.40 |
| Chile | 265.9 | 5.42 | 7.76 | 8.86 | .... | .... | 0.35 | .... | 8.51 | .... |
| Granby | 57.5 | 11.64 | 12.55 | 15.00 | 16.35 | 0.83 | 1.27 | 1.25 | 13.75 | 15.10 |
| Howe Sound | 42.2 | 27.15 | 28.20 | 30.32 | .... | 21.72 | 22.63 | (h) 21.94 | 8.38 | .... |
| Inspiration | 88.1 | (g) 9.94 | 10.32 | 11.17 | .... | .... | 0.04 | .... | 11.13 | .... |
| Kennecott (including Braden and Utah) | 520.1 | 7.72 | 8.94 | 9.69 | .... | 0.54 | (n) 1.99 | (k) 1.88 | 7.81 | .... |
| Kennecott (including Braden) | 246.3 | 8.34 | 9.96 | 10.99 | .... | 0.06 | 2.80 | (k) 2.57 | 8.42 | .... |
| Magma | 36.5 | 9.86 | 11.02 | 12.13 | .... | 2.20 | 2.38 | .... | 9.75 | .... |
| Miami | 48.3 | 11.10 | 11.90 | 12.76 | .... | .... | (i) 0.72 | .... | 12.04 | .... |
| Mohawk | 21.2 | 7.35 | 8.01 | 9.08 | 9.69 | .... | 0.73 | .... | 8.35 | 8.96 |
| Mother Lode | 13.4 | 10.90 | 12.46 | .... | .... | 0.36 | 0.37 | .... | (o) 12.09 | .... |
| Nevada Consolidated | 268.5 | 9.20 | 9.78 | 10.46 | .... | 0.53 | 1.04 | .... | 9.42 | .... |
| Noranda | 33.3 | 8.26 | 9.69 | 12.89 | .... | (l) 3.42 | 3.67 | 1.89 | 11.00 | .... |
| Phelps Dodge | 204.3 | (j) 14.58 | .... | 15.75 | .... | (l) 0.98 | (2j) 4.18 | .... | 11.57 | .... |
| United Verde Extension | 45.2 | 7.30 | 8.68 | 9.69 | 14.89 | 0.84 | 2.16 | .... | 7.53 | 12.73 |
| Utah | 273.8 | 7.16 | 8.04 | 8.53 | .... | 0.96 | (n) 1.24 | .... | 7.29 | .... |

(a) Selling, administration, federal and state taxes.
(b) Includes railroad operating charges and taxes. (2b) Includes $844,000 operating revenue of railroad.
(c) Depreciation assumed at $275,000, depletion at $412,000 of total charge of $687,000.
(d) One-half profits Champion mine paid to St. Mary's Mineral Land Company, plus interest on railroad bonds.
(e) 40 per cent to depreciation, 60 per cent to depletion assumed for total charge of $4,434,500.
(f) Estimate based on foreign prices for lead and zinc.
(g) Includes federal taxes.
(h) Examinations, prospecting and other charges.
(i) Does not include $567,000 credit adjustment in value of securities.
(j) Total expenditures minus $4,496,000 merchandise sales. (2j) Includes $3,452,000 precious metals in purchased ores and estimate of coal sales.
(k) Distribution to minority stockholders.
(l) Based on average prices published in *E.&M.J.*
(m) New Cornelia dividend deducted.
(n) 43 per cent of Nevada Consolidated dividend deducted.
(o) Before depreciation and depletion.

sible to segregate it from the Alaskan operations of Kennecott. Among those with relatively high direct operating costs are Calumet & Arizona, Granby, Miami, Mother Lode, and Inspiration.

**Table III—Taxes and Interest, Per Pound Copper**

| | Cents |
|---|---|
| Inspiration | 0.38 |
| Nevada Consolidated | 0.58 |
| Mohawk | 0.66 |
| Miami | 0.80 |
| Cerro de Pasco | 0.86 |
| Utah | 0.88 |
| Granby | 0.91 |
| Howe Sound | 1.05 |
| Magma | 1.16 |
| Kennecott (including Braden and Utah) | 1.22 |
| Calumet & Arizona | 1.29 |
| Calumet & Hecla | 1.37 |
| United Verde Extension | 1.38 |
| Calumet & Arizona (new) | 1.38 |
| Noranda | 1.43 |
| New Cornelia | 1.46 |
| Mother Lode | 1.56 |
| Kennecott (including Braden) | 1.62 |
| Chile | 2.34 |
| Andes | 3.51 |

If from the operating cost the income from sundry metals be subtracted, a figure is obtained that reflects in a rough way the operating status of the company as affected by the content of the ore in copper and other metals, and the efficiency of mining and treatment. Table II shows the companies in sequence. On this basis of calculation, Cerro de Pasco, Noranda, and Howe Sound come among the leaders.

Wide variation is to be found in the item "Taxes and Interest" as shown in Table III. Chile (2.34c.), Andes (3.51c.) and Kennecott (including Braden but not Utah) (1.62c.) are the highest. With respect to Andes and Chile, bond interest is a big item, but the incidence of high taxes in Chile is apparent.

**Table IV—Depreciation, Per Pound Copper**

| | Cents |
|---|---|
| Utah | 0.49 |
| Andes | 0.53 |
| New Cornelia | 0.59 |
| Nevada Consolidated | 0.68 |
| Calumet & Arizona (new) | 0.72 |
| Kennecott (including Braden and Utah) | 0.75 |
| Inspiration | 0.85 |
| Miami | 0.86 |
| Calumet & Arizona | 0.92 |
| United Verde Extension | 1.01 |
| Kennecott (including Braden) | 1.03 |
| Mohawk | 1.07 |
| Chile | 1.10 |
| Magma | 1.11 |
| Copper Range | 1.13 |
| Phelps Dodge | 1.17 |
| Calumet & Hecla | 1.43 |
| Cerro de Pasco | 1.81 |
| Howe Sound | 2.12 |
| Granby | 2.45 |
| Noranda | 3.20 |

Depreciation, except in a few instances, is an item that is isolated in the accounts so that it can be ascertained exactly. The three largest, perhaps not entirely by coincidence, are companies operating in Canada: Noranda, 3.20c.; Granby, 2.45c.; and Howe Sound, 2.12c., as shown in Table IV. The Granby report explains that a large allowance was permitted by the government in respect to the abandonment of the Boundary property. Noranda, with a new plant, doubtless followed sound accounting practice in writing off a substantial sum. Little comment is called for in connection with the charge for depletion, few of the companies making any provision in their published reports. Parenthetically it should be said, however, that in arriving at an approximation of a "reasonable" market price for copper, an allowance ranging up to perhaps 3c. per pound, depending principally on the nearness of the probable date of exhaustion of the ore deposits, should be made.

Data under the head of "Sundry Metal Income" reveal that most of the copper ores contain substantial amounts of gold and silver. Among those that realize little or nothing from this source are the Michigan companies, and Miami, Inspiration, Chile, and Braden. Aside from Cerro de Pasco and Howe Sound, the companies that profit most from other metals are Magma, Calumet & Arizona, and Noranda, the last named having an ore with high gold content.

Table V shows the figures that come closest to representing those usually published as the cost of production. They take into account bond interest and taxes, income from investments, and realization from precious metals and sundry products other than copper. Depreciation is included, but *not* depletion. Dividends paid by Nevada to Utah Copper and by New Cornelia to Calumet & Arizona in 1928 are not credited. If Utah were credited with its share of Nevada's dividends, the cost would be reduced to about 5.9c. per pound, putting it in a class by itself, except for Cerro de Pasco. Likewise, the cost of Kennecott (including both Braden and Utah) would be reduced substantially.

**Table V—Per-Pound Cost After Depreciation and Sundry Credits, But Before Depletion**

| | Cents |
|---|---|
| Cerro de Pasco | 3.69 |
| Utah | 7.29 |
| United Verde Extension | 7.53 |
| Kennecott (including Braden and Utah) | 7.81 |
| Mohawk | 8.35 |
| Howe Sound | 8.38 |
| Kennecott (including Braden) | 8.42 |
| Chile | 8.51 |
| New Cornelia | 9.30 |
| Nevada | 9.42 |
| Calumet & Arizona (new) | 9.51 |
| Andes | 9.69 |
| Magma | 9.75 |
| Calumet & Arizona | 9.83 |
| Calumet & Hecla | 10.67 |
| Noranda | 11.00 |
| Inspiration | 11.13 |
| Phelps Dodge | 11.57 |
| Miami | 12.04 |
| Mother Lode | 12.09 |
| Copper Range | 13.10 |
| Granby | 13.75 |

Cerro de Pasco heads both this list and that in Table II. Emphasis should be placed on the fact that considerably more than half of the company's income is derived from the sale of silver, lead, and zinc. It is possible that with an increase in the output of these metals and a modest decline in copper production, the apparent per-pound cost of copper will be less than nothing, calculated on the basis used in the accompanying tables. Less than half of the income of Howe Sound in 1928 came from copper sales, so that the situation with respect to that company is similar except that the resulting costs are not so low.

In Table VI the production of the companies under consideration is allocated according to the per-pound cost, after depreciation. The total of 2,122,000,000 lb. is approximately two-thirds of the total production of North and South America and the percentages shown in the table probably are applicable with reasonable accuracy to the total production of the world.

**Table VI—Allocation of 2,122,000,000 Lb. of Copper According to Per-Pound Cost After Depreciation**

| Cost Range | Per Cent of Total | | Per Cent Cumulative |
|---|---|---|---|
| Under 8c. | 28.9 | | 28.9 |
| 8 to 9c. | 17.6 | Under 9c. | 46.5 |
| 9 to 10c. | 25.5 | Under 10c. | 72.0 |
| 10 to 11c. | 5.7 | Under 11c. | 77.7 |
| 11 to 12c. | 15.4 | Under 12c. | 93.1 |
| Over 12c. | 6.8 | | .... |

## Mining Practice at Morenci, Arizona

DETAILED DATA in regard to mining practice at the Humboldt copper mine, Morenci, Ariz., are given in Information Circular 6107, recently issued by the U. S. Bureau of Mines. This paper is the first of a series of publications dealing with the caving method of mining and is to be followed by similar papers on other mines in Arizona and in other districts throughout the United States where this system is used. At the same time that these reports are being prepared for publication—there will be a dozen or more—material is being collected for a general bulletin presenting the caving system of mining, its application and limitations under various conditions, with discussions of the problems encountered and their solutions. These papers are all being written by officials and engineers of the mining companies in accordance with an outline prepared by the Bureau of Mines for the purpose of obtaining uniform and comparable data.

At present virtually all the mineral production in the Morenci district is from the Humboldt mine, state the authors, McHenry Mosier and Gerald Sherman. The mining method used is adapted to the type of orebody being exploited; it has been developed by adopting methods used elsewhere and making necessary changes to fit local conditions. Improvements in current practices are still being made. The Clifton-Morenci district is in southeastern Arizona on the southern slope of the Gila range of mountains, near the junction of the Gila and San Francisco rivers. Clifton is about 69 miles by rail northwest of Lordsburg, N. M., on the Southern Pacific Railroad. Morenci is served by a narrow-gage freight railroad from Clifton.

Gold was discovered in 1872 by a party of prospectors from Silver City, N. M., said to have been connected with the U. S. Army. Copper ore indications were noted on Copper Mountain, and several claims were staked, for copper ore, but because of the lack of rail transportation in the early days the first real interest was in gold. The first copper smelting began in 1873, when a cupola furnace having a capacity of one ton per day was built, but at that time only the very richest ores could be treated.

The railroad was built through Lordsburg in 1881, and a branch line was extended to Clifton in 1884. The building of the railroads stimulated mining in the district by decreasing operating costs. In 1882, both the Detroit Copper Company and the Arizona Copper Company, Ltd., were organized. In 1900 the Shannon Consolidated Copper Company began operations. The first smelters in the district treated copper oxide ores mined from sedimentaries near the main porphyry contact. In 1893 chalcocite orebodies were opened in the Copper Mountain porphyry. As the rich oxide ores became depleted, attention was directed to the lower-grade ores in the porphyry. The first concentrator was built in 1886.

In 1922 the Arizona Copper Company, Ltd., which had previously absorbed the Shannon Copper Company, merged with the Phelps Dodge Corporation, whose Morenci Branch was originally the Detroit Copper Company. Important economies in operations were made possible by this consolidation for the following reasons: (1) On account of contiguous orebodies, which are now being mined as single units by cheaper methods at a more intense rate; (2) by milling all ores at one concentrator, remodeled to treat efficiently the present ores; (3) by smelting ores and concentrates at one modern plant; and (4) by reducing overhead and certain operating costs through the elimination of duplication, as one organization now serves in the place of two.

The annual production from the district attained its peak in 1916, with 70,000,000 lb. of copper. At present the output is almost 60,000,000 lb. per year; it is produced by concentrating 1,500,000 tons and by smelting a small tonnage of furnace ores and converter flux. To the end of 1927 the district had produced a total of approximately 1,800,000,000 lb. of copper.

Humboldt mine is in the center of the town of Morenci at the foot of Copper Mountain. The mine has been worked almost continuously for nearly 40 years. The report just issued contains detailed information in regard to methods of prospecting and exploration; sampling and estimating tonnage and grade; development work; drilling and blasting; driving of drifts; and shaft sinking. The early mining methods employed at the mine are discussed. Considerable space is given to the principles of mining by the undercut block caving method, including details of the stoping system, underground transportation, hoisting, ventilation and drainage. Information is given as to the wage system in force, it being noted that 72 per cent of all labor in the mining department is paid on bonus or contract systems. Information is presented as to mining and development costs and accident-prevention measures employed. Copies of Information Circular 6107, "Mining Practice at Morenci Branch, Phelps Dodge Corporation, Morenci, Ariz.," may be obtained from the U. S. Bureau of Mines, Department of Commerce, Washington, D. C.

## A Ninety Million Dollar Bill for Supplies

THE annual statistics issued by the South African government on the purchase of supplies by the mines of the Union show that the 1928 total came to approximately £17,850,000, or close to ninety million dollars, of which about 36 per cent was imported. However, a much larger proportion of the machinery used has to be imported, the total named including large quantities of foodstuffs and timber, obtained locally. The following are a few of the more important items of expenditure by the Witwatersrand gold mines in 1928:

| | |
|---|---|
| Electric power and light | £1,735,624 |
| Gelignite and gelatin dynamite | 1,519,903 |
| Steam coal | 809,572 |
| Rock drill spares | 491,758 |
| Machinery and machine tools | 402,711 |
| Machine spares | 300,748 |
| Pipes and pipe fittings | 405,476 |
| Rails, crossings, sleepers | 295,181 |
| Wire ropes | 202,942 |
| Capped fuses | 403,134 |
| Candles | 122,154 |
| Carbide | 109,485 |
| Electrical machinery | 380,892 |
| Electrical machinery spares | 111,721 |
| Hand tools | 109,583 |
| Hosing | 107,685 |
| Rock drill steel | 310,493 |

During the year the mines produced 10,358,000 oz. of gold from approximately thirty million tons of ore.

*Two steam wells in California discharging with open throttles*

# MINING FOR POWER

By F. H. MASON

MINING for power indirectly is an ancient custom, for heat is power, and mining for coal has been a common operation for centuries, and boring for oil for many decades; but boring directly for power is an achievement of the present century and only recently has been brought to commercial success. Beneath the comparatively thin crust of the earth is stored an immense quantity of heat—hence power—but to reach this source and harness it for the use of man has been fraught with difficulties heretofore impossible to overcome. The thickness of the earth's crust, however, varies, and in some places it is considerably shattered, allowing evidence of the internal heat to come to the surface through cracks or faults, in the form of hot springs, geysers and fumaroles or steam jets. The last-named class of natural phenomena seems to offer the best opportunity for successful boring for power.

One of the largest known areas in which fumaroles occur is the country for some 100 square miles around Larderello, in Tuscany. There the steam jets contain a considerable proportion of boric and carbonic acids, boric acid being volatile in steam; small quantities of hydrogen sulphide, marsh gas, hydrogen, and nitrogen; and minute quantities of the rare gases, argon and helium. For more than a century the recovery of boric acid from these fumaroles by condensation of the steam and the evaporation of the resulting liquor has been one of the principal industries at Larderello, but it is only within recent years that any attempt has been made to use steam as a direct source of power.

In 1904, Prince Piero Ginori Conti started his experiments to utilize this source of steam for power purposes. A bore was made in a favorable place, the hole cased, and the casing capped by a valve through which steam was supplied to a small reciprocating engine. The result was so successful that the small engine was replaced by a larger one of the same type, and was run successfully until 1913, when more ambitious plans were attempted. Other wells were bored, from some of which pressures up to 130 lb. were obtained. An attempt was made to operate a turbine-type engine, geared to a 250-kw. generator, but the successful operation of this engine was dependent on the condensation of the steam, and trouble arose because the gases accompanying the steam were not condensable. An attempt was then made to utilize the steam, which was issuing from the valves of the well casings at temperatures up to 160 deg. C., to heat water and thereby generate pure steam. This, though sound in theory, failed in practice because of faulty tubes which allowed some of the natural steam and its concomitant non-condensable gases to mingle with the generated steam. Finally, an apparatus was devised whereby 90 per cent of the non-condensable gases was separated from the steam and sent directly to the chemical works. The steam, thus freed from most of the non-condensable gases, was used successfully to operate a turbo engine. The industry has grown until today some

*Photos by courtesy of The Carnegie Institution of Washington*

7,000 kw. is generated at and around Larderello by natural steam. Conditions similar to those at Larderello are found around The Geysers, which is situated 35 miles north of San Francisco and about 30 miles from the Pacific Coast. There is the difference, however, in that the fumaroles at The Geysers do not emit important quantities of boric acid and therefore have not attracted the attention of industrial chemists. Supposed curative properties of the hot springs—which also are found in the district—both for medicinal and bathing purposes, have attracted invalids for more than three-quarters of a century, and the occurrences of cinnabar have attracted miners. The name given to the place many years ago is misleading, as no true geysers have been found in the district. In 1921, James Grant, a practical miner without any knowledge of the success that had been achieved at Larderello, conceived the idea of using for power purposes the steam escaping from the fumaroles. He started to bore with a churn drill for a greater force of steam at depth, but was not prepared for the pressure that he found at a shallow level. When he attempted to cap the well, the casing was blown out and he lost the hole. In the following year he bored a second hole, secured the casing by pouring several hundred pounds of molten zinc around it, and successfully capped the well, which is 203 ft. deep, with a valve. The well developed a pressure of 62 lb. Encouraged by this success he started another well—using steam from No. 1 for power—sank it to a depth of 318 ft., and successfully capped it. This well developed a pressure of 61 lb. The supply of steam seemed inexhaustible, for if either well was allowed to discharge with throttle full open for months it rapidly recovered its normal pressure after the throttle was closed. Nor did the dissipation of the steam at one well affect the pressure of the steam at the other, though the wells are only 50 ft. apart.

*Well No. 6 at The Geysers. Completed and shut off.*

A company was then formed to take over the enterprise, and in 1925 the Diamond Drill Contracting Company, of Los Angeles, undertook the work and sank five wells to depths respectively of 451, 416, 487, 438, and 650 ft. These wells developed pressures respectively of 107, 211, 276, and 290 lb. No. 8 has not been capped, for, though deeper than the others, the pressure is markedly less. J. D. Galloway, who has supervised the drilling for the company, estimates that wells Nos. 4, 5, 6, and 7, are capable of giving a switchboard delivery of 4,500 kw. after allowing 10 per cent for loss in steam transmission.

This account of development at The Geysers has been abstracted from a brochure entitled, "Steam Wells and Other Thermal Activities at The Geysers, California," by E. T. Allen, and A. T. Day, which has been issued by the Carnegie Institution of Washington. The authors have spent much time, careful research, and study on their subject, and in their account enter fully into the temperatures, pressures, and analyses of the waters and steams, and into the geological and topographical conditions of the district in which they occur, all of which are likely to have an important bearing on the ultimate success of this infant industry. Already bores have been sunk in several other parts of the world, including one at Imperial Valley, California, which is said to have attained an output of 900 kw. at a depth of 750 ft. Varying results have been secured elsewhere, several bores having given considerable promise of important power development. It may reasonably be expected, therefore, that this new form of mining ultimately may gradually take its place alongside of mining for metals and fuel in districts where the development of power at reasonable depths is possible. Such districts usually, if not invariably, will be of a volcanic nature.

## Low Prices Apparently Not Killing Malayan Tin Industry

REPORTS current from time to time in recent months that a large number of Chinese-owned mines in Malaya were forced to close because of the comparatively low level of tin prices, thus reducing production, should be accepted with reservation, says Commerce Reports. According to statistics for the Federated Malay States for mines employing machinery or having a force of 100 or more coolies, 189 were closed during the year, but 173 opened or reopened, thus indicating that the effect of the low tin prices was practically negligible as regards the net number of mines closed, even though profits were obviously less.

From merely a couple of dredges working in the Federated Malay States in the years 1912 to 1914, the number had increased to no fewer than 89 at the end of 1928, according to the *Metal Bulletin*. In the twelve months these produced 433,772 piculs of ore and employed a force of 14,212. (One picul equals 133⅓ lb.) In January, 1929, there were twenty dredges proposed and under construction. In Perak, Selangor, North Sembilan, and Pahang 72 dredging, 46 hydraulicking, and 383 gravel-pump systems are reported operating—with 33 miscellaneous, a total of 534.

# *An Example of Prospecting and Valuing*

# A Lead-Zinc Deposit

By WILLIAM F. NETZEBAND
*Mining Geologist, Joplin, Mo.*

THE CHARACTER *of geologic formations in which orebodies of the Tri-State district occur necessitates the use of churn drills in exploration from the surface. Study of zones of shearing by a competent geologist and the application of an experience factor are important in appraising the probable value of an undeveloped property.*

OREBODIES in the Kansas-Oklahoma area of the Tri-State district of Kansas-Oklahoma-Missouri are found in rocks of Mississippian age, principally in the cherts of the Boone formation, but with minor orebodies occurring in the overlying Chester formation. These orebodies are of three types. First is the soft-ground type found in the Chester and upper portions of the Boone. Second, and most important, is the brecciated and boulder-ground type, which occurs in the Lincolnville chert between the "green lime" horizon above and the Short Creek oölite horizon below, and in the cherts within the horizon 40 ft. below the Short Creek oölite. The third is the sheet-ground type found in the Grand Falls chert at the base of that portion of the Boone which corresponds to the Keokuk formation.

The soft-ground orebodies are no longer important, having been mined out in the early days in the vicinity of Lincolnville and in the area north of Miami, Okla. Ore in this type of orebody occurred in the shale, which had filtered down into the broken sandstones of the Chester and the crushed cherts of the upper Boone. These orebodies were rich but pockety, and were soon mined out.

Brecciated and boulder ground contains the most important orebodies in the Kansas-Oklahoma area. Some of the orebodies of the Lincolnville chert are of the semi-sheet-ground type, the gangue being a bedded white and blue to gray chert; lenses of sphalerite and galena occur along the bedding planes. In the area around Treece, Kan., and Hockerville, Okla., the Lincolnville chert has been subjected to shearing stresses followed by solution, forming orebodies of the boulder type. The sphalerite and galena occur disseminated in jasperoid breccia and lining interstices between boulders of chert and jasperoid breccia. This type of orebody is usually rich but

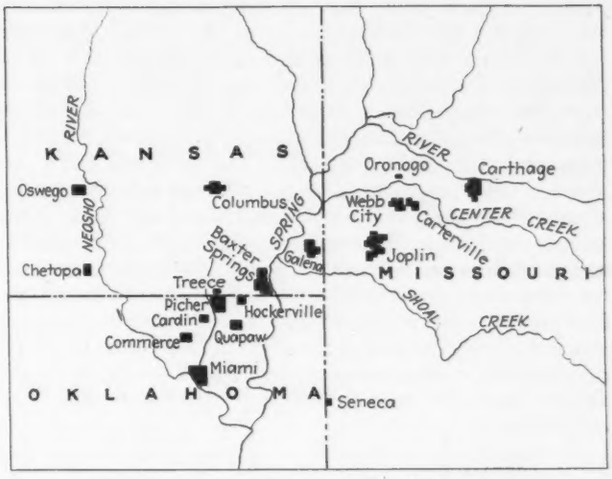



*Fig. 1 — Sketch map of the Tri-State district*

narrow. Orebodies from the horizon immediately under the Short Creek oölite have produced most of the ore of the main Picher (Okla.) camp. These orebodies are principally sphalerite and galena disseminated through jasperoid breccia, or are bands or patches of solid ore; they contain considerable calcite and dolomite as gangue minerals. In the heart of the Picher (Okla.) camp, single orebodies of such deposits have been mined over more than 40 acres.

Sheet-ground orebodies of the Grand Falls chert have only recently come into production in the Kansas-Oklahoma area, chiefly in the vicinity of Baxter Springs, Kan. The dominant features of this type of orebody are its low grade and persistence over large areas. Ore occurs as lenses along bedding planes and lining vugs and small caves in the chert. The chert is the bedded blue and gray chert characteristic of the famous Webb City-Carterville (Mo.) area. These mines near Baxter Springs, Kan., are being developed as large-tonnage, low-cost projects.

Surface prospecting is carried on entirely by churn drills, as the character of the ground prohibits the use of diamond or shot drills. Drill rigs are all of the portable type, with the power unit and derrick mounted on the frame of the jack. Most of the rigs used are of the type developed in the district by the Keystone Driller Company, of Joplin, Mo. Standard tools consist of a 6¼-in. bit, 26-ft. stem, jars, and rope socket. The bailers are usually of the flat-bottom type rather than the dart type used in the oil fields.

For ordinary ground, the hole is started and finished with the 6¼-in. bit, but for soft caving ground a hole is

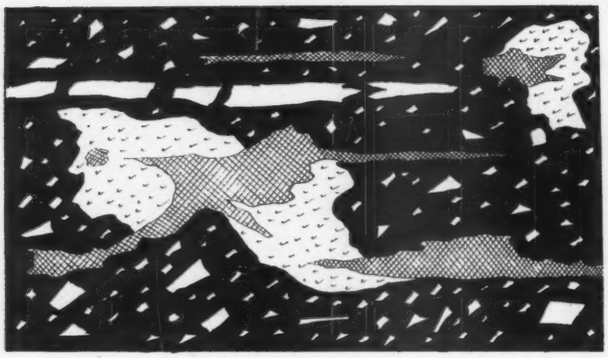
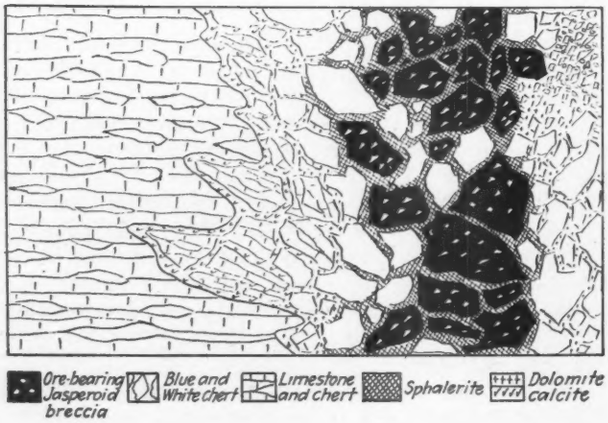


*Fig. 2 — Typical brecciated-ground orebody*

started with a 10-in. bit, changing to an 8-in. and then to a 6¼-in., and finishing with a 4¼-in. bit. Practically all the churn drill work is done by contract, few of the operating companies owning their own rigs. Many of the contractors own a single rig and operate it, but the tendency is for a single contractor to own two or more rigs and hire drill runners. The contract price for drilling is $1 per foot. This price varies according to the character of the ground and the depth of the hole. When caving or boulder ground is encountered, necessitating the use of several strings of casing, the price is changed to compensate for the extra time required to finish the hole. The usual depth of hole is less than 300 ft., but often a 350-ft. hole is drilled for $1 per foot. Contracts are verbal for the most part, and very few disputes have arisen between the operating company and the contractor.

A complete log is kept of every hole drilled, regardless of whether or not commercial mineralization is encountered in drilling the hole. Often the formation in a blank hole will furnish valuable information. Five-foot screws are usually run, and a sample of every screw is piled on the ground and properly tagged as to depth. When ore is encountered, the cuttings are allowed to settle in a tub and the clear water is decanted off; then either a can is provided or a hole dug in the ground and a thoroughly mixed sample weighing from 10 to 20 lb. put into it. Care must be taken that the sample is thoroughly mixed, for the sphalerite is rather friable and tends to sludge, throwing much of the valuable constituents into the fines and slimes, whereas the galena tends to settle to the bottom of the sample. From the original sample saved by the drill runner, a sample of about 5 lb. is obtained for assay.

*Fig. 3 — Typical boulder-ground orebody*




Most of the larger companies employ a geologist or field superintendent, who makes up the written log of the hole. The formations are not logged in detail, but are usually specified as lime or flint, the color of which is suffixed in each instance. Ore grades are variously described, no great uniformity being practiced. For grades of less than 2 per cent zinc sulphide and 1 per cent lead sulphide, however, the term shines is applied. For grades greater than these, most companies have assays made, and it has been found that the various terms applied, such as "fair shines," "good shines," "fair jack" (zinc sulphide), and "good jack," are open to various interpretations when compared with the assay. A typical drill log follows:

| From | To | Formation |
|---|---|---|
| (In Feet) | | |
| 0 | 53 | Shale |
| 53 | 160 | White lime |
| 160 | 175 | White flint and gray lime |
| 175 | 210 | White and blue flint |
| 210 | 220 | White and brown flint |
| 220 | 222 | Opening |
| 222 | 230 | White and blue flint, lead shines, fair jack |
| 230 | 242 | White and blue flint, lead traces, fair jack shines |
| 242 | 248 | Hard white water flint |

*Assay*

| | | PbS | ZnS |
|---|---|---|---|
| 222 | 230 | 1.40 | 11.55 |
| 230 | 242 | Trace | 3.25 |

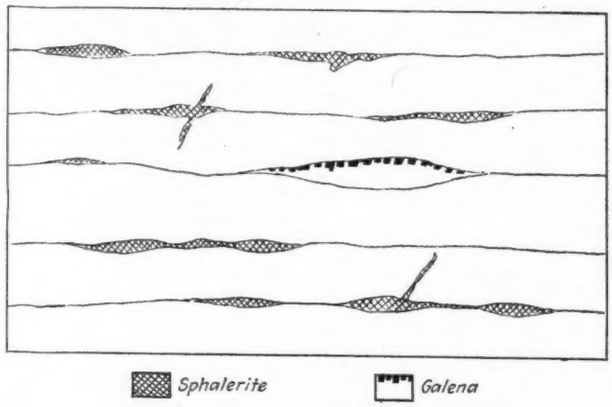



*Fig. 4 — Typical sheet-ground orebody*

Several of the operating companies collect samples of cuttings from every hole and paste them on a card so that later there can be no question as to a field man's log. This practice requires a great deal of storage space, and most companies do not feel that its advantages balance the disadvantages. Some of the companies have made a practice of carding only typical holes from various sections of the district, especially of those drilled in wildcat territory.

## Underground Prospecting of Developed Properties

After a mine has been put in operation, there are many places that cannot be drilled from the surface. Three methods of prospecting such territory are in use. Originally, all such territory was prospected by 5x7-ft. drifts. These were either driven toward a definite objective, such as an ore hole or a group of holes some distance from the main workings, or driven blindly into virgin territory at such places as the walls of the mine indicated were the most favorable. This method of prospecting was rather expensive, for even on contract the company paid the contractor a minimum of $5 per foot and furnished equipment and air, and in many cases the explosives also. If driven toward a definite objective, there was a reasonable expectancy that the drift could later be used for haulage, but when driven blindly

the chances of salvaging any commercially valuable material from the drift were more remote. Blind drifting has never been popular in the district.

In 1925 a heavy-duty hammer drill with sectional steels for drilling horizontal holes to a depth of 250 ft. was introduced by the Denver Rock Drill Manufacturing Company. Results obtained with it were discussed by the present writer in a previous paper[1]. Costs of this method have been reduced, so that the average cost of drilling ranges from $0.60 to $1.75 per foot. When inexperienced drill runners are employed or the ground is broken and contains numerous caves, the costs are still high, reaching a maximum of $6 per foot.

One company has adopted the practice of driving long prospect drifts, usually connecting two otherwise isolated mine workings, and then drilling a series of long holes in the shape of a fan from these drifts. This method eliminates the possibility of passing by a parallel run or an upper ore horizon. Fig. 5 illustrates the general arrangement employed in drilling the holes.

Many of the early drill holes were stopped in the first ore horizon encountered or because the ground was difficult to drill on account of the excessive water present. As the mines were opened up, and the water table was lowered, some ore was found at lower levels. Much of this ground cannot be prospected from the surface, so small churn drills have been installed under-

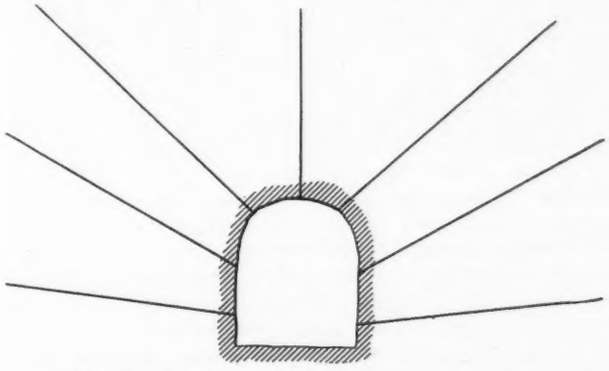


*Fig. 5 — Sketch showing arrangement of holes in long-hole drilling*

ground. These drills have been used both for finding new orebodies and for testing the stope under the present workings. Compressed air is used as power for these drills. One company has found that a cross bit can be used advantageously in boulder ground where considerable difficulty is experienced in keeping the hole straight. Average cost of underground prospecting with the churn drill is $2 per foot. This type of prospecting is done on company time, the rig being owned by the company.

## Method Used in Mine Valuation

During the period from 1914 to 1924, properties were valued on the analyses of churn-drill records, and only the positive ore was given any weight. Since 1924, with the experience gained in mining the orebodies, and because of the coming into the district of many outside companies, principally those with galvanizing or zinc smelting connections, the probable and possible ore has been taken into consideration in valuing a property.

Better to illustrate the method of mine valuation used in the district, a typical property that has been exhausted has been taken as an example. The value placed on this

[1]Netzeband, W. F.: "Underground Deep-Hole Drilling at the Eagle-Picher Mines." A.I.M.E. *Trans.*, Vol. 75, pp. 35-41, 1927.

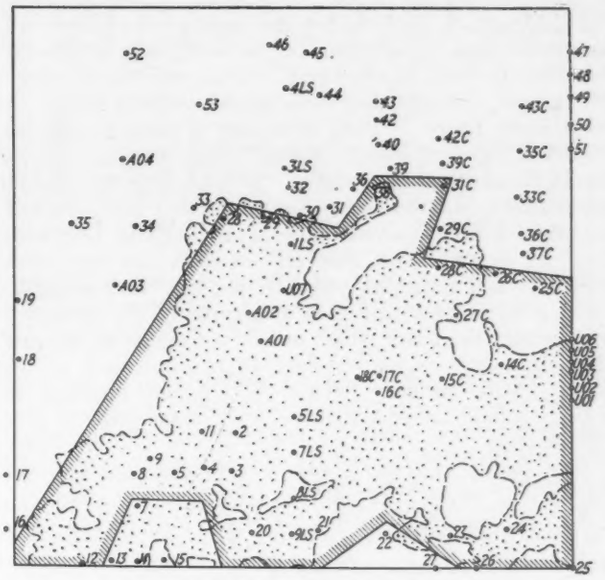


*Fig. 6—Map of tract showing ore reserves as blocked out by drilling and the area actually mined when the property was abandoned*

property is based on all the drilling data available. A comparison of the estimated tonnage of both rock and concentrates, with the actual tonnage obtained of each, will be made. The property under consideration was a 40-acre tract which was mined intermittently from 1916 to 1928. Drilling done on the tract, ore reserves blocked out as a result of the drilling, and the area actually mined are shown in Fig. 6. Accuracy of the estimated ore reserves by this method is plainly indicated.

**Table I**

| Hole Number | Depth in Feet | Face in Feet | Per Cent ZnS | Per Cent PbS | Total, Per Cent | Feet-Per Cent Zns | Feet-Per Cent PbS | Total Feet-Per Cent |
|---|---|---|---|---|---|---|---|---|
| 1 | 240–245 | 5 | 2.00 | ..... | 2.00 | 10.00 | ..... | 10.00 |
| 2 | 245–260 | 15 | 3.43 | ..... | 3.43 | 51.45 | ..... | 51.45 |
| 3 | 240–255 | 15 | 4.00 | ..... | 4.00 | 60.00 | ..... | 60.00 |
| 4 | 250–260 | 10 | 1.00 | ..... | 1.00 | 10.00 | ..... | 10.00 |
| 5 | 222–238 | 16 | 9.35 | 0.12 | 9.47 | 149.60 | 1.92 | 151.52 |
| 8 | 222–237 | 15 | 21.33 | 0.04 | 21.37 | 319.95 | 0.60 | 321.55 |
| 9 | 230–240 | 10 | 6.18 | 0.85 | 7.03 | 61.80 | 8.50 | 70.30 |
| 11 | 225–240 | 15 | 15.97 | 2.52 | 18.49 | 239.55 | 37.80 | 277.35 |
| 12 | 225–235 | 10 | 7.30 | 0.12 | 7.42 | 73.00 | 1.20 | 74.20 |
| 20 | 222–242 | 20 | 6.57 | 0.56 | 7.13 | 131.40 | 11.20 | 142.60 |
| 21 | 235–240 | 5 | 9.97 | 0.21 | 10.18 | 49.85 | 1.05 | 50.90 |
| 23 | 235–254 | 9 | 2.38 | ..... | 2.38 | 21.42 | ..... | 21.42 |
| 24 | 225–235 | 10 | 0.72 | 12.85 | 13.57 | 7.20 | 128.50 | 135.70 |
| 25 | 240–245 | 5 | ..... | 2.50 | 2.50 | ..... | 12.50 | 12.50 |
| 26 | 231–245 | 14 | 5.36 | 1.78 | 7.14 | 75.04 | 24.92 | 99.96 |
| 28 | 230–240 | 10 | 3.22 | 0.08 | 3.30 | 32.20 | 0.80 | 33.00 |
| 29 | 235–252 | 17 | 4.83 | 0.38 | 5.21 | 82.11 | 6.46 | 88.57 |
| 38 | 230–255 | 25 | 4.02 | ..... | 4.02 | 100.50 | ..... | 100.50 |
| 14C | 237–248 | 11 | 4.60 | 0.90 | 5.50 | 50.60 | 9.90 | 60.50 |
| 15C | 231–248 | 17 | 5.46 | 1.73 | 8.19 | 92.82 | 29.41 | 122.23 |
| 16C | 238–247 | 9 | 4.00 | 3.00 | 7.00 | 36.00 | 27.00 | 63.00 |
| 17C | 237–241 | 4 | 6.00 | ..... | 6.00 | 24.00 | ..... | 24.00 |
| 18C | 220–250 | 30 | 3.00 | ..... | 3.00 | 90.00 | ..... | 90.00 |
| 25C | 205–230 | 25 | 3.50 | ..... | 3.50 | 87.50 | ..... | 87.50 |
| 26C | 245–255 | 10 | 4.00 | ..... | 4.00 | 40.00 | ..... | 40.00 |
| 27C | 240–255 | 15 | 1.90 | 0.11 | 2.01 | 28.50 | 1.65 | 30.15 |
| 28C | 245–250 | 5 | 3.50 | 2.500 | 6.00 | 17.50 | 12.50 | 30.00 |
| 31C | 240–255 | 15 | 4.50 | ..... | 4.50 | 67.50 | ..... | 67.50 |
| A01 | 225–235 | 10 | 2.29 | 1.95 | 4.24 | 22.90 | 19.50 | 42.40 |
| A02 | 230–245 | 15 | 1.35 | 5.56 | 6.91 | 20.25 | 83.40 | 103.65 |
| 1LS | | | | | Blank | | | |
| 5LS | 250–265 | 15 | 7.10 | 0.07 | 7.17 | 106.50 | 1.05 | 107.55 |
| 7LS | 245–262 | 17 | 4.10 | 2.03 | 6.13 | 69.70 | 34.51 | 104.21 |
| 8LS | 240–245 | 5 | ..... | 1.50 | 1.50 | ..... | 7.50 | 7.50 |
| 9LS | 240–255 | 15 | 1.50 | 0.20 | 1.70 | 22.50 | 3.00 | 25.50 |
| U01 | 237–242 | 5 | ..... | 1.50 | 1.50 | ..... | 7.50 | 7.50 |
| U02 | 230–235 | 5 | ..... | 2.82 | 2.82 | ..... | 14.10 | 14.10 |
| U03 | | | | | Blank | | | |
| U04 | 235–245 | 10 | 7.05 | ..... | 7.05 | 70.50 | ..... | 70.50 |
| U05 | 230–245 | 15 | 15.40 | ..... | 15.40 | 231.20 | ..... | 231.20 |
| U06 | 235–242 | 7 | 7.72 | ..... | 7.72 | 54.04 | ..... | 54.04 |
| 41 | (Totals) | 486 | | | | 2,607.08 | 486.47 | 3,093.55 |
| | Averages.... | 11.85 | | | | 5.36 (Per Cent ZnS) | 1.00 (Per Cent PbS) | 6.3 (Total Per Cent ZnS and PbS) |

The area of the block as obtained by planimeter is 827,520 sq.ft. To obtain the average recovery and height of face, an analysis of the drill holes within the blocked-out area is necessary. This analysis is shown in Table I. In analyzing drill records without assays, an experience factor is used to assign a value to the ore found. This experience factor varies within narrow limits for different engineers, but as a general rule all mineralized material above 2 per cent has been assayed. Results of this analysis indicate an average height of face of 11.85 ft., a recovery of 5.36 per cent zinc sulphide, and a recovery of 1.00 per cent lead sulphide, or a total recovery of 6.36 per cent. The unminable area within the block which is left for pillars or because the ore is low grade is taken as 12½ per cent of the block. Mill efficiency before the days of flotation, in which period most of this ore was mined, was 80 per cent.

The prices received for zinc and lead concentrates during the years 1920 to 1927 inclusive are shown in Table II. Average prices for these eight years were

**Table II**

| Year | Price of Zinc Concentrates | Price of Lead Concentrates |
|---|---|---|
| 1920 | $44.87 | $89.72 |
| 1921 | 23.19 | 50.12 |
| 1922 | 33.80 | 76.32 |
| 1923 | 40.53 | 93.00 |
| 1924 | 42.27 | 105.01 |
| 1925 | 52.99 | 115.57 |
| 1926 | 48.67 | 104.52 |
| 1927 | 40.60 | 85.61 |

$41 per ton for zinc concentrates and $90 per ton for lead concentrates. These eight years are representative of the trend of prices for the post-war years, and include two years of low prices and a counterbalancing two years of high prices. The prices are based on 60 per cent metal for zinc concentrates and 80 per cent metal for lead concentrates. Actual grade of the concentrates at this particular mine has been above this base, so the prices received have been correspondingly higher, but this fact cannot be taken into consideration in a valuation study of the mine prior to its development.

Rock-ton costs for the district have averaged $2 during the period since the war. Cost of drilling, sinking, and opening the mine for production, together with the cost of the mill, has been estimated at $1 per rock ton for one year based on the annual capacity of the mill—that is, a mill of 300 tons working 300 days per year would handle 90,000 tons of rock annually, and the cost of bringing the mine to the production stage would be $90,000.

Using the aforesaid figures, the following calculations indicate the net profit to be expected from operation of the property:

Area: 827,520 sq.ft.
Height of face: 11.85 ft.
827,520 × 11.85 = 9,806112 cu.ft. in area
9,806,112 = 784,489 rock tons in area
12.5
784,489 × 0.125 = 98,061 rock tons in pillars, 12½ per cent of area being allotted to pillars.
784,489 — 98,061 = 686,428 net rock tons available.
686,428 × 0.0536 = 36,792 gross tons of zinc concentrates
36,792 × 0.80 = 29,434 net tons of zinc concentrates, mill efficiency being 80 per cent
686,428 × 0.01 = 6,864 gross tons of lead concentrates
6,864 × 0.80 = 5,491 net tons of lead concentrates, mill efficiency being at 80 per cent
29,434 × $41 = $1,206,794 gross value of zinc concentrates
5,491 × $90 = $494,190 gross value of lead concentrates

| | |
|---|---|
| Gross value of zinc concentrates, | $1,206,794 |
| Gross value of lead concentrates, | 494,190 |
| Total gross value of concentrates, | $1,700,984 |

Annual mill capacity on the basis of 300 rock tons milled daily and 300 working days: 90,000 rock tons
Cost of mill and development on basis of $1 per rock ton for one year: $1 × 90,000 = $90,000
Cost of mining and milling on basis of $2 average rock ton cost: 686,428 × $2 = $1,372,856
Royalty at 12½ per cent of the gross sales: $1,700,984 × 0.125 = $212,623

**Summary**

| | |
|---|---|
| Total gross value of concentrates | $1,700,984 |
| Value of royalty | 212,623 |
| Net value of concentrates | $1,588,361 |
| Cost of mining and milling | $1,372,856 |
| Cost of mill and development | 90,000 |
| Total cost of producing concentrates | $1,462,856 |
| Net value of concentrates | $1,588,361 |
| Total cost of producing concentrates | 1,462,856 |
| Net profit | $125,505 |

From the foregoing calculations the estimated net profit would not seem to warrant the expenditure of the capital necessary to bring the mine into production. It has been found by experience that actual production is greater than that estimated. For several mines with which I have had experience, the actual production has exceeded by 10 per cent the estimated production, even when calculating the mill efficiency at 100 per cent instead of at 80 per cent. The property in question milled 721,904 rock-tons, recovering 37,322 tons of zinc concentrates and 13,933 tons of lead concentrates. This compares favorably with the estimated gross recovery of 36,792 tons of zinc concentrates, but doubles the estimated gross recovery of 6,864 tons of lead concentrates. The actual percentage recovery was 5.17 per cent for zinc and 1.93 per cent for lead, as compared with the estimated percentage recovery of 5.36 per cent for zinc and 1.00 per cent for lead. This comparison of estimated and actual production will hold true for most of the properties of the district where care has been taken in the drilling and a conservative analysis made of the drill records.

With the experience gained prior to 1924, probable and possible ore is considered in estimating the ore reserves on a property, and the geology of the mined portion of the property is also given consideration. The principal geological features to look for in making a mine examination, besides the ore occurrence, are the zones of shearing. These zones are intimately connected with ore deposition, and a thorough study of them is always advisable. This study must be made by a competent geologist, for there are several types of shear zones, and their differences must be recognized.

Two methods of calculating ore reserves are now in use in the district. One method assigns to separate blocks the several types of ore and considers the blocks 100 per cent ore. The other method takes a given block and assigns to it the several types of ore. Each type of ore is given a certain percentage of the whole. The second method requires more experience and judgment on the part of the examining engineer than the first, for it can readily be seen that no two engineers would give the several types of ore the same weight, and the consideration given the calculations would be directly proportional to the experience of the examining engineer. The second method of figuring reserves allows the engineer more leeway in considering, as possible ore, reserves for which he can give no definite reason for so considering, but which his experience indicates have a possible chance of being present. With the first method of assigning each type of ore into separate blocks, a definite reason must be given for every block of possible ore. Another feature of the first method that is of minor importance, but which may prove embarrassing at times, is the fact that the engineer must commit himself to a definite location for his possible ore, whereas, in the second method, the possible ore is placed somewhere in a large block, and it is always a minor part of the block.

# *The Selection and Application of* Wire-Rope Lubricant

By C. D. MEALS
*Chief Engineer, American Cable Company, New York, N. Y.*

MOST USERS of wire rope are aware of the fact that, at the time the rope is fabricated, its core is impregnated with a chemically neutral lubricant. Unfortunately, however, many of these users are not aware that this initial lubrication of the core is not permanent; and that, if maximum life from a wire rope in service is to be obtained, the rope must be effectively lubricated at frequent intervals—this implying the use of a lubricant of the correct grade, properly applied. In other words, though the "life" of a wire rope is influenced by such factors as method and materials of construction, manner of winding, intensity of the service, high temperatures, presence of water, acids or alkalies, the most important factor determining how long the rope will last is the degree to which it is protected by effective lubrication.

Some essential facts that should be known about the selection and application of lubricant to wire rope in order to obtain most effective lubrication will be discussed here.

### WHY LUBRICATION IS NECESSARY

Wire rope cores are of two main types: Those with a hemp center, and those with a wire-rope center. Generally, however, a core of hempen fiber is employed. Use of a lubricated hemp core in a wire rope serves two main purposes: It insures protection against rust and corrosion of the inner strands, and the maintenance of adequate flexibility with a minimum of friction when the rope is first put into service, thereby preserving the fibers of the core. The life of a wire line is largely dependent upon the core. This fact emphasizes the need for efficient lubrication; for the purpose of the hempen core, in addition to the functions mentioned, is to provide a medium for the absorption of the lubricant and to cushion the interior faces of the strands. Consequently, when the core becomes dry and worn, the rope no longer receives adequate lubrication. Conversely, if a wire rope in service is not lubricated at frequent intervals, the core will become excessively dry and deteriorated—to the ultimate serious detriment to the rope.

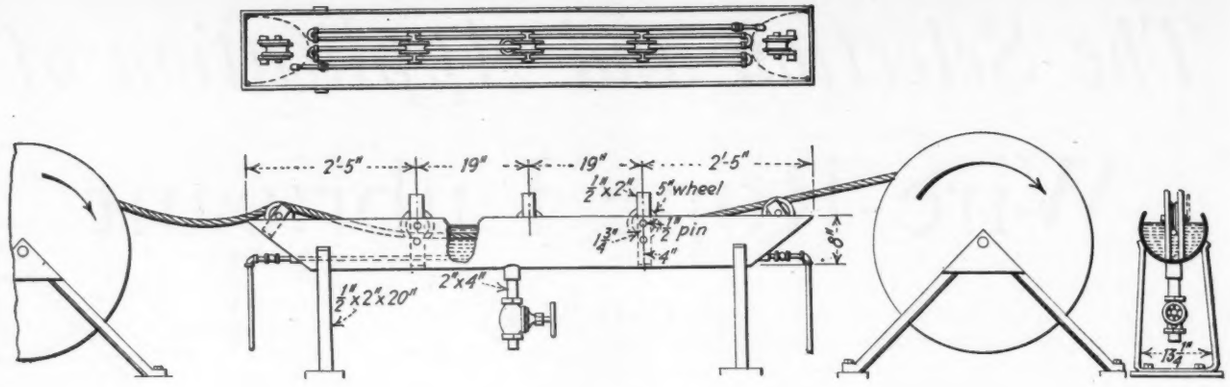
Wear in any wire rope in active service, however, cannot be wholly eliminated; for it is impossible to prevent some friction between individual strands of the rope and between the sheaves or winding drums and the rope's exterior surface. But friction—and, therefore, wear and increased bending stresses—can be minimized by selecting a suitable rope lubricant and applying it properly; and deterioration caused by such factors as water, acids, alkalies, high temperatures, or corrosive fumes can be materially lessened by the use of a lubricant possessing the qualifications essential for the particular conditions of rope use.

When a rope is bent, friction develops between the inner strands. Consequently, the use of a lubricant is necessary to decrease this friction. Because bending tends to squeeze out lubricant from the core and inner surfaces of the rope, re-application of lubricant at regular intervals becomes necessary. By using sheaves or drums of large diameter the bending of a rope will not be so sharp and, therefore, less lubricant will be squeezed out. On the other hand, small sheaves necessitate the more frequent lubrication of the rope in order to keep wear to a minimum.

Life of the core depends largely upon its being lubricated at all times. Even an axial stress on the rope causes compression of the core. In addition, deterioration results from the crushing action that takes place when the steel strands press into the hempen core, as the rope is wound on and off the sheave or drum. Core wear is minimized by keeping it impregnated with lubricant at all times. A dry core not only will absorb moisture, but will also deteriorate and crush quicker than a well-lubricated one. From the foregoing, it becomes evident that lubrication of a wire rope is necessary: (1) To retard rust and corrosion; (2) to reduce the internal friction between the individual inner strands; (3) to reduce the external wear by minimizing the friction between the outer surfaces of the rope and the drums or sheaves; (4) to retard the deterioration of the core by maintaining it in the proper state of softness and pliability. The core on new wire rope retains quite a supply of the original lubricant, but, as a further assurance that frictional wear and core deterioration will be kept at a minimum, lubricating the rope just after installation and before putting into service (particularly such ropes as have been kept in storage for some time) is recommended.

### SELECTION OF LUBRICANT

To obtain the longest service from a wire rope, lubricant used thereon must be selected with the class of service in which the rope is used definitely in mind. A lubricant that will prove suitable on a slow-speed derrick cable will not give equal satisfaction if applied to a high-speed mine hoisting rope. Several qualities, however, should be possessed by all wire-rope lubricants, regardless of rope service, namely: (1) Ability to adhere firmly, at all times, under the heavy rubbing and scraping action of the wires; (2) ability to penetrate between the strands to the core and to impregnate the hemp center; (3) freedom from acids, alkalies, or any other harmful ingredients that might pit or corrode the strands; (4) ability of the film of lubricant to spread itself—it must be flexible enough in its characteristics so that the rope can pass freely over the sheaves without danger of the




*A simple tank-type of lubricator*

lubricant's either coming off or opening up to admit moisture; (5) preferably, should not evaporate or harden upon prolonged exposure to the air, nor be affected by moisture or corrosive fumes, if they are encountered in service.

Wire ropes may be divided into five general classes as follows: (1) Slow-speed ropes operating under heavy loads; (2) high-speed hoisting ropes; (3) haulage and slope ropes run at high speeds and under heavy loads; (4) general haulage ropes and ropes of lighter duty than those of Class 3; (5) stationary ropes exposed to moisture, corrosive fumes, or spray. Each of these classes demands certain particular qualifications in the lubricant used, which qualifications are not necessarily common to the other classes. For slow-speed ropes operating under heavy loads, such as the ropes used on derricks, dredges, cranes, and steam shovels, a lubricant of heavy body and of adequate adhesive characteristics, applied cold, will give satisfactory results; so, too, will a straight petroleum product, having a viscosity of 900 to 1,100 sec. at 210 deg. F., applied hot. High-speed hoisting ropes, such as mine-shaft ropes, need a lubricant of relatively low viscosity, possessing great penetrative and adhering qualities and capable of saturating the rope thoroughly. Where automatic cable lubricating devices are utilized for applying lubricant to such cables, a light lubricant with a viscosity of 350 to 500 sec. at 100 deg. F. will prove satisfactory. Where application with a brush is required, a lighter lubricant should be used. Furnace hoists, derrick falls, logging ropes, coal-mine slope and shaft ropes, and haulage ropes and other ropes running at high speeds and under heavy loads require a mineral oil lubricant having a viscosity of 500 to 800 sec. at 210 deg. F. General haulage ropes and ropes of lighter duty should be lubricated with a mineral oil of a lower viscosity, such as 200 to 300 sec. at 210 deg. F. However, there should be no lessening in the adhering, penetrating, or lubricating qualities of the lubricant. For stationary ropes exposed to moisture, corrosive fumes, or spray, either a grease or an oil can be used with equal satisfaction, provided the lubricant adheres to the rope under all conditions of service and forms a suitable protective coating. A straight petroleum product with a viscosity of 900 to 1,100 sec. at 210 deg. F., previously mentioned, will meet this requirement.

The following general comments are applicable to the selection of a wire-rope lubricant:

1. The lubricant should be fluid enough to penetrate the strands and the core, but not so fluid as to run off the rope nor so viscous as merely to cover the rope.

2. Tar products are not absolutely waterproof, are deficient in lubricating qualities, and, in addition, usually contain tarry acids which tend to corrode the rope, especially in the presence of moisture. Further, such products, on exposure to the air, eventually harden, crack, and peel off the wire strands.

3. Soap-thickened mineral oils, that is, greases, although they can be made to the same consistency as the average straight mineral wire-rope lubricant, are usually deficient in adhering and penetrating qualities.

4. The greater the speed of a rope in service, the lower should be the viscosity of the lubricant used on the rope.

5. Wherever possible, it is best to utilize a thicker, semi-plastic lubricant and to apply it hot in a thinned condition, rather than to apply cold a more fluid lubricant. Where field conditions are such that cold application only is practical, a chemically neutral rope lubricant should be used. Do not use crude oil, inasmuch as it is generally chemically injurious to the core and steel in the rope.

6. Where the rope must function under excessively abrasive conditions, such as in sand and gravel quarries, select a lubricant having high surface-protective ability in addition to lubricating, adhering, and penetrating qualities.

### Application of Lubricant

Selecting a wire-rope lubricant with care means little unless the lubricant chosen be judiciously applied. Applying the lubricant hot is recommended practice; for, thereby, the compound will penetrate and then cool to a plastic filler, thus preventing the entrance of water and serving to preserve and to lubricate the inner wires and core. This can best be done by slowly passing the rope through a heated bath of the oil. Another method, though wasteful of lubricant, and which is, therefore, recommended only when conditions are such that immersion is impracticable, consists in placing a drum of the lubricant, warmed by a steam-heating coil within the drum, above the rope and then allowing the lubricant to run out on the rope through a suitable outlet valve. A brush for spreading should be placed, with bristles up, below the flow of lubricant and in adjustable contact with the rope.

Under no conditions is hand application of lubricant to wire rope entirely satisfactory, but it is better than no lubrication at all. In applying lubricant by hand, several methods are in use. In all of them best results are obtained if a piece of sheepskin, wool side turned in, is employed; otherwise, a bunch of waste may be used. These methods are feasible only when the rope

can be slowed down sufficiently. In the treatment of vertical and inclined ropes, lubrication can be accomplished by permitting the rope to move slowly through lubricant-soaked waste or sheepskin, which can be either held in the hands of the workmen or bound in place. With slow-moving horizontal ropes, the lubricant can be poured with a dipper over the rope, catching the excess in a bucket beneath, and "working in" with sheepskin or waste placed back of the point where the lubricant is poured on. Another method consists in having the rope pass through a V-shaped wooden trough located on the ground, pouring the hot lubricant on the rope, and wiping off the excess with a bunch of waste held near the front of the trough.

Hand application of lubricant to wire rope, at best, is a messy job, and if much rope is to be lubricated, or lubrication at frequent intervals is necessary, it is advisable to use special appliances (which can be made readily), whereby messiness and waste of lubricant will be avoided. In designing such devices, the fact should be borne in mind that, if at all possible, it is most practical and economical to lubricate a rope without removing it from service. A design for such a device is shown in the accompanying illustration.

Although all wire ropes, unless otherwise specified, are lubricated and impregnated in the manufacturing process with a compound that will protect the rope both internally and externally to a maximum degree and will minimize rust or corrosion until the rope is put into service, this initial lubrication is not permanent; therefore, the rope should be lubricated after installation and before being used, especially so if it has been in storage for a year or more. Thereafter, the frequency of lubrication will depend upon service conditions. So long as the rope is pliable and shows evidence of lubricant in the crevices between strands, it does not require frequent lubrication. In general, the heavier the duty, the higher the operating speeds, the greater the number of small bends, or the more deteriorating the atmospheric or fluid conditions, the more frequently should lubricant be applied. A wire rope that is to be taken out of service and stored should be well lubricated, and the outer surfaces given a thorough protective coating, before being put away.

It is just as feasible to expect the average automobile engine to function without oil, and without damage to the engine, as to expect a wire rope to have a long life without the use of a carefully selected lubricant, properly applied.

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## A Mica-Splitting Process and Equipment

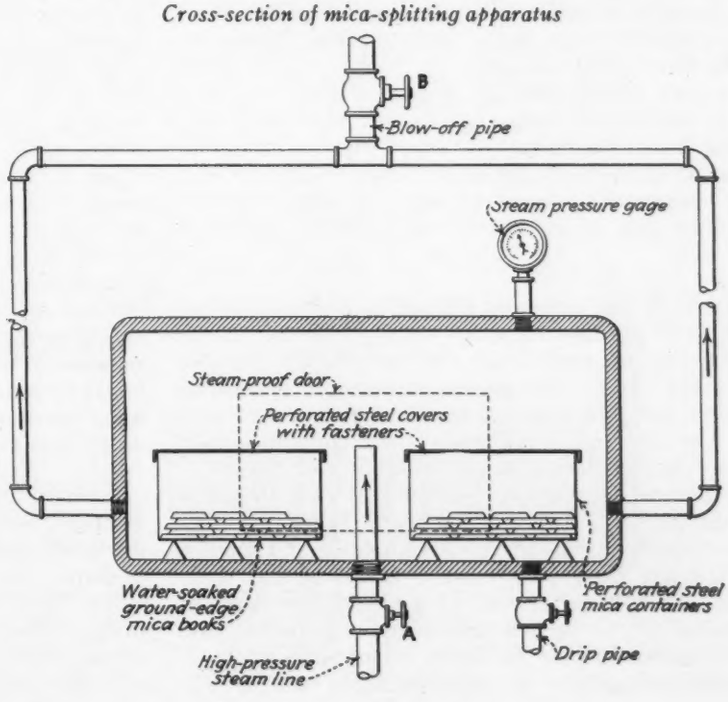
By H. N. Kirk

FOR MANY YEARS a need has prevailed in the United States for a cheap method of producing mica splittings suitable for the manufacture of built-up mica board. Hand methods have so far been employed, but such procedure cannot be used by domestic manufacturers as long as splittings are obtainable from India, where labor is much cheaper. In a war emergency, moreover, with supplies cut off, many thousands of workers would have to be employed here to produce by hand methods the quantity of mica splittings that is imported annually from India. Patents have been granted for several mica-splitting devices, but apparently no lessening in the demand for India "splits" has been effected. As a mechanical means of making mica splits in this country, therefore, should be valuable, I am presenting here a sketch of an experimental device which I believe may point the way toward solving the problem of making mica splits on a large scale in the United States.

As shown in the sketch, the device is essentially a small steel chamber of sufficient strength to withstand a pressure of at least 700 lb. per square inch. A hand hole, indicated by dotted lines and oblong in shape, is provided with a cover which may be removed when the perforated containers, inclosing the small books of mica, are to be placed into the chamber or withdrawn. When the chamber is in operation the hand-hole cover is securely fastened and sealed to withstand high-pressure steam. The books of mica are rifted from a quarter to an eighth of an inch thick and the edges beveled on a coarse emery wheel. This procedure loosens the leaves of mica slightly, so that subsequently, when the books are placed in a tank of water, the water penetrates under the loosened sheets. After the books are soaked, a sufficient number are placed in the perforated steel containers to occupy about a third of the space available. The containers are then placed in the chamber, the steam-proof hand-hole is cover fastened, and all outlets from the chamber are closed. Steam at about 600-lb. pressure to the square inch is then introduced into the chamber through valve *A*. This high-pressure steam changes the water that has been absorbed by the mica books into steam. This steam, in turn, tends to further loosen the mica leaves. When the gage shows a pressure of 600 lb., indicating that this pressure prevails throughout the chamber, the valve at *A* is closed and the blow-off valve at *B* opened.

Opening of the blow-off valve suddenly reduces the pressure in the chamber from 600 lb. to atmospheric pressure of about 15 lb., and this I believe will cause the interlocked steam between the sheets of mica to expand and the mica to be rifted into thin sheets.

*Cross-section of mica-splitting apparatus*



# Modern Mine Practice

## *In the Construction of a*

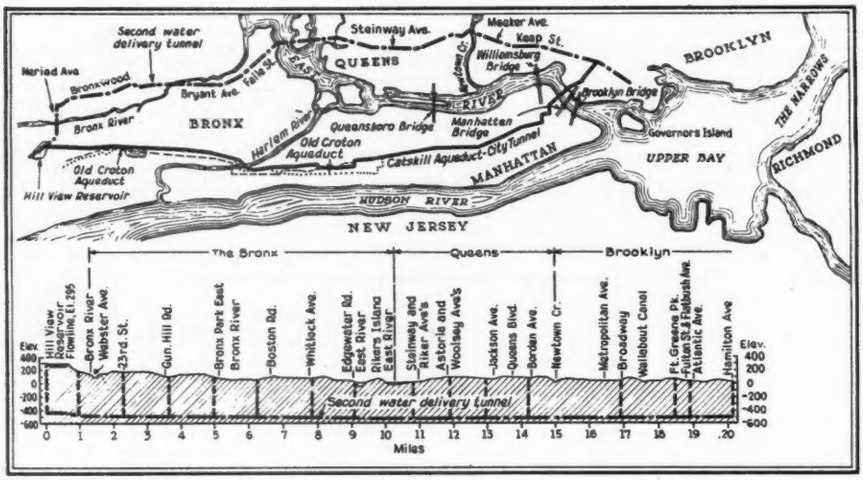



*Fig. 1*

*Map of proposed tunnel under New York City*

FAR BELOW the streets of New York City an army of workmen will soon be engaged in the gigantic enterprise of constructing a water tunnel. Sixteen electric mine hoists and 62 mine locomotives will be used in this project.

The new tunnel, officially known as City Tunnel C No. 2, will be constructed by Patrick McGovern, Inc., for the Municipal Board of Water Supply. The mine hoists and locomotives and other electric equipment, now being built by the General Electric Company, will form the major part of the electric motor-driven machinery to be used.

New York City now uses 875 million gallons of water per day, 30 per cent of which comes from the Croton reservoir system and 70 per cent of which is supplied by Catskill water. The present distribution system has long been recognized as inadequate for future needs, and even now it is not large enough to maintain suitable pressure in the Boroughs of Brooklyn and Queens.

The new tunnel will run from the Hill View Reservoir east through the Bronx, then south under the East River through Queens to Brooklyn, ending at Hamilton Ave. opposite Governor's Island. It will be 20.2 miles long, 17 ft. in diameter when finished, and at a depth of about 500 ft. below sea level. Its construction will involve the sinking of 16 shafts from 14 to 22 ft. in diameter, the depths of the different shafts varying from 500 to 850 ft., according to the land elevation. After the tunnel is completed, these shafts—with the exception of that at Hill View, to be used as an intake—will be used as risers to valve chambers from which the street mains will be supplied. The tunnel and shafts, aggregating 22 miles linear measurement, will be excavated to 19 ft. diameter, which will involve the blasting and removal of almost four million cubic yards of hard rock. Lining the tunnel to 17 ft. diameter and incidental construction work will require the placing of 664,000 cu.yd. of concrete. This work, together with other minor items, is to be completed in 70 months.

Electricity will play a vital part in the undertaking. Air for drills and shovels will be furnished by 400-hp. synchronous motor-driven compressors. As the rock is removed it will be hauled through the tunnels to the hoists by storage-battery mine locomotives. Any seepage water encountered will be pumped out by motor-driven centrifugal pumps.

Each of the mine hoists in the main shafts will be equipped with two cages, in balance, one coming up as the other goes down. These cages will be rectangular in shape. The shaft is to be cylindrical. The remaining space will be used for water pipes, air pipes, and electric cables. The 30-ton hoists to lift the cages will have drums about 7 ft. in diameter, will make 22 r.p.m., and will wind hoisting ropes $1\frac{1}{4}$ in. in diameter. Each hoist

# a 20-Mile Aqueduct

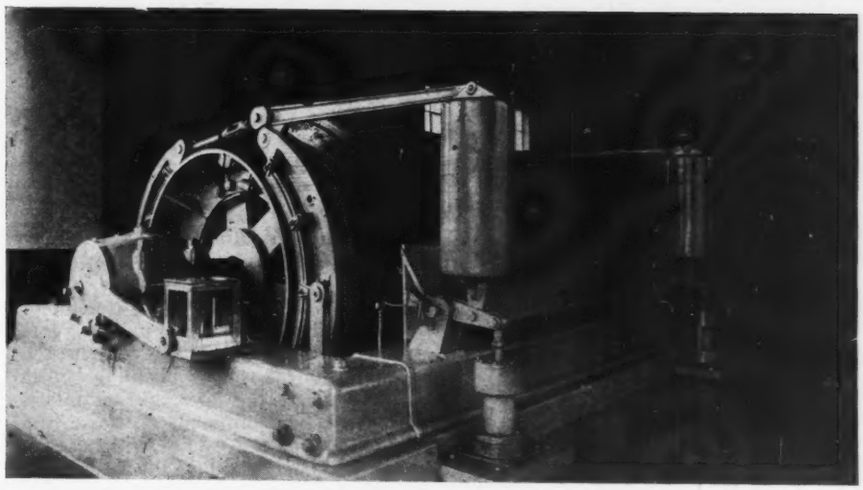


*Fig. 2—The removal of rock will be by electric power through sixteen shafts. Each hoist, operating rectangular cages in a circular shaft, will be driven by a 250-hp. G.E. motor with variable generator voltage control.*

*Fig. 3—The tunnel will be excavated to 19 ft. diameter. When completed with concrete lining it will be 17 ft. diameter. The total length will be about twenty miles, and the project will be completed in about six years.*

will be driven by a 250-hp. General Electric motor with variable generator voltage (Ward Leonard) control. Each motor will require a motor-generator set consisting of a 350-hp. synchronous motor, a 200-kw. direct-current motor and an 8-kw. exciter.

Sixty-two 7-ton storage-battery mine locomotives will be used for haulage in the tunnel. These machines, now being built by the General Electric Company, will correspond in type to those used in the construction of the Cascade, Moffett, Hetch-Hetchy, Shandakin and Cold Brook-Wachusett tunnels. Each locomotive will be driven by two 12-hp. motors, power for which will be furnished by a storage battery consisting of 42 Exide cells. When the batteries are discharged, the locomotives will be hoisted to the surface for recharging the batteries.

Electric power for the project will be purchased from six public service companies, and the various voltages will be stepped down to operating values by suitable transformers, except where the higher voltages are suitable for operating the larger motors.

# COMMENT AND CRITICISM

## *Substantial Industrial Progress in Russia Is Claimed*

*To the Editor of "E.&M.J.":*

In the issue of May 4 appears a letter by Alexei P. Maradudin, entitled "Hardships of the Soviet Mining and Metallurgical Industries." The writer dwells at length on the difficulties that certain Soviet producing organizations have met in expanding production, such as the comparative scarcity of technical men, large labor turnover, and lack of materials.

That many deficiencies and cases of mismanagement can be reported in a country which has always been backward industrially and in which modern methods of management have only begun to take effect, is not, of course, surprising. The fact that the reports in question were culled from the Soviet press indicates that these shortcomings are being realistically faced. But it is regrettable that Mr. Maradudin, while devoting so much attention to illustrations of the difficulties encountered in developing Soviet industries, has failed to point out the substantial progress made in reconstructing them to, and in most instances above, the highest pre-war level.

In 1920-21 the production of most minerals and metals amounted only to 10 to 15 per cent of the pre-war volume. The process of reconstruction took five years for completion. During the past Soviet fiscal year, ending Sept. 30, 1928, production of the principal minerals and metals, in comparison with 1913, was as follows:

| | 1913 | 1927-28 |
|---|---|---|
| | Metric Tons | |
| Coal | 29,053,100 | 35,185,600 |
| Crude oil | 9,234,900 | 11,815,400 |
| Kerosene | 1,552,800 | 1,909,500 |
| Peat, dry | 1,724,000 | 5,311,400 |
| Iron ore | 9,214,600 | 6,030,100 |
| Steel | 4,246,900 | 4,153,500 |
| Soda, calcined | 151,012 | 207,271 |
| Superphosphates | 62,862 | 151,392 |
| Salt | 1,978,000 | 2,323,300 |

It will be seen that with the exception of iron ore and steel (also copper ore), production was well above the pre-war level. Last year industrial production as a whole increased over 20 per cent over the preceding year. This fiscal year a similar increase over 1927-28 is expected.

The figures for March, 1929, the last month for which data are available, fully bear out these expectations. Production of coal, oil, steel, and superphosphates for large-scale industries for March in comparison with the monthly average for 1913 is shown below:

| | Monthly Average 1913 | March 1929 |
|---|---|---|
| | Metric Tons | |
| Coal | 2,421,000 | 3,500,000 |
| Oil | 769,600 | 995,000 |
| Steel | 353,900 | 416,000 |
| Superphosphates | 5,240 | 17,000 |

Incidentally, it may be pointed out that though multiplicity of planning agencies is an evil that has been eliminated with marked success by Soviet authorities, the notable development of Soviet industry in the last few years would have been impossible without the existence of the central planning bodies to co-ordinate the operation of industries with the minimum of waste and duplication. These bodies will be even more effective in aiding the realization of the ambitious program of industrial development planned for the coming years.

M. MENDELSON,
*Information Department,*
*Amtorg Trading Corporation*
*New York, N. Y.*

## *Has Ontario's Gold Production Reached Its Peak?*

*To the Editor of "E.&M.J.":*

Stock markets are notoriously unique in the matter of appraising earning possibilities these days, and to venture a statement as to the prosperity of an industry, based solely on the stock-market valuation of the important companies in that industry at any given moment, might possibly lead the ignorant into error. In a general way, however, even stock prices reflect expected conditions over a period of years, so that the fact that gold stocks on the Canadian mining exchanges, since the last half of 1927, have been declining in value or merely holding their own, and that gold production in Ontario has shown little change, is not merely a coincidence. For the last few months most of the Canadian brokers' sheets have been exhorting their readers to buy "golds," pointing out that all of the established dividend payers, Lake Shore excepted, are giving very fair returns on current quotations and that possibilities are far from remote that some of these companies may increase production, with corresponding increases in dividends. But the buying public stays shy and the brokers are denied the bull market that would mean increased commissions for them.

Two years ago Ontario was looked on as the one new gold field of importance in the world, and the achievements of Kirkland Lake and Porcupine were pointed out with justifiable pride. Today, the customary attitude is that, although gold mining is important, of course, the interesting possibility is Canada's chance of standing third among the copper-producing countries by 1933, possibly second by 1937 and perhaps even first at some more distant but not unhoped-for date. One might, with justice, paraphrase, "Inconstancy, thy name is newspaper dope." The fickleness of the public and the press can be explained, however.

Ontario's gold production declined slightly during 1928, from the high of $33,500,000 produced in 1927, and has since continued at the rate of about $32,000,000 a year. Although the output of the mines at Kirkland Lake has increased, the decrease from the Porcupine district, caused by the disappointments at Hollinger, has offset this gain. Until last month no new producer had been added outside these two districts. Is $33,500,000 likely therefore to be the peak of Ontario's gold production?

No very great increase over its present rate is expected from Porcupine, which seems to be passing its peak. The Hollinger annual meeting indicated that that property is not likely to produce much more than $10,000,000 a year in the future, or less than two-thirds of its record 1926 output. Dome has been doing well recently, with the grade of material handled increasing sufficiently to make a substantial difference in output, but the management is not willing to commit itself to more than four years' additional life for the mine. McIntyre-Porcupine is the only one of the big producers and Vipond the only one of the smaller mines that appear to be on the up grade. Mining men are talking of a mill increase for McIntyre-Porcupine, which might make up some of the production decrease resulting from the drop at Hollinger. Coniaurum is in the hands of receivers, and plans for making a low-grade mine out of Porcupine Paymaster have gone astray.

Teck-Hughes and Lake Shore are bright spots at Kirkland Lake, particularly the latter, which is confidently expected to supersede Hollinger as Canada's largest gold mine. Estimates of potential ore at Lake Shore range from

$125,000,000, which is now being called conservative, to $300,000,000 The lower figure would mean ten years of production at the rate of 2,000 tons daily, or $12,500,000 a year. Teck-Hughes is opening up six new levels, and results from this work are expected to justify the addition of at least one 300-ton unit to the mill, which would mean an increase of about one-third over the present output of nearly $5,000,000 a year. Wright-Hargreaves, on the other hand, is passing through a very trying period and is operating only one 350-ton section of its mill. This is at the rate of about $800,000 a year on an average grade of $7 a ton. The two other producers on the main break—Sylvanite and Kirkland Lake Gold—are making just enough money to finance development campaigns. A great newspaper hue and cry was made about the mines at the eastern end of the district, but none of these properties seems any nearer production than it was before the publicity began.

Outside of the two established producing districts, numberless discoveries have been made, and two mines have produced small quantities of high-grade ore within the last month or so. Bobjo Mines shipped 600 lb. of ore by airplane, from which about $5,000 in gold was recovered. Bathurst Mines has also recovered some gold at its pilot mill, but Howey Gold is the only mine that is fairly certain to produce on a large scale. Based on present plans of 500 tons of $7 ore daily, its output would be $1,000,000 annually. The gold content in the Frood mine is also a matter of general interest but little knowledge. If production is brought up to 100,000 tons of copper annually, as construction now under way would indicate, an output of $1,000,000 or $2,000,000 in gold could be expected. Utah Copper produced about $2,000,000 in gold from its operations last year, in which it also produced about 135,000 tons of copper. In the following table is listed probable and possible production in Ontario in 1931, when both Frood and Howey should be in operation, based on present plants, and additions that are under consideration or decided on:

**Porcupine**

| | *Probable* | *Possible* |
|---|---|---|
| *Hollinger* | $10,000,000 | $12,000,000 |
| *McIntyre-Porcupine* | 4,500,000 | 6,500,000 |
| *Dome* | 4,000,000 | 4,500,000 |
| *Miscellaneous* | 500,000 | 1,000,000 |
| | $19,000,000 | $24,000,000 |

**Kirkland Lake**

| | | |
|---|---|---|
| *Lake Shore* | $12,500,000 | $15,000,000 |
| *Teck-Hughes* | 5,000,000 | 6,500,000 |
| *Wright-Hargreaves* | 800,000 | 2,000,000 |
| *Kirkland Lake Gold* | 400,000 | 800,000 |
| *Sylvanite* | 600,000 | 1,000,000 |
| | $19,300,000 | $25,300,000 |

**Miscellaneous**

| | | |
|---|---|---|
| *Frood* | $1,000,000 | $2,000,000 |
| *Howey* | 1,000,000 | 2,000,000 |
| *Other Mines* | 250,000 | (?) |
| | $2,250,000 | $4,000,000 |
| *Totals* | $41,550,000 | $53,300,000 |

On the basis of these assumptions, Ontario's gold production is almost certain to exceed its 1927 output, probably by as much as $7,000,000 and possibly by a great deal more. If one of the numerous districts in the "North Country" turns out to be a second Porcupine, as it well might, these calculations would naturally appear ridiculous. In any event, the upward trend of Ontario's gold production has probably been halted only momentarily. Incidentally, note that these calculations indicate that as soon as Lake Shore gets going, Kirkland Lake will probably supersede Porcupine as Canada's leading gold district.

AN OCCASIONAL CONTRIBUTOR.
*Toronto, Ont.*

## *Mining Companies Adopt Electric Foundry Furnaces*

*To the Editor of "E.&M.J.":*

On page 728 of your May 4 issue I note your request for information concerning electric furnaces used in the mining industry. Additional mining companies using electric furnaces and the period that each company has had such equipment in operation follow:

Nevada Consolidated Copper Company, McGill, Nev.; two years.

Braden Copper Company, Chile; six months.

United Verde Copper Company, Clarkdale, Ariz.; two years.

Bethlehem Steel Company, Chile; four years.

Anglo-Chilean Nitrate Company, Chile; two years.

Cerro de Pasco Copper Corporation, Peru; three years.

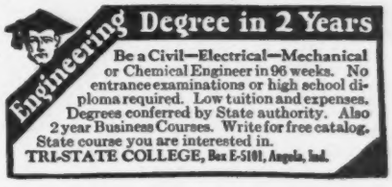
Union Minière du Haut-Katanga, Belgian Congo; three years.

LARRY J. BARTON.
*Consulting Foundry Engineer.*
*Angels Camp, Calif.*

## *Where Mining Engineering Is Not Taught*

*To the Editor of "E.&M.J.":*

Permit me to call attention to the attached advertisement, clipped from a recent issue of a popular magazine.



Engineering Degree in 2 Years
Be a Civil—Electrical—Mechanical or Chemical Engineer in 96 weeks. No entrance examinations or high school diploma required. Low tuition and expenses. Degrees conferred by State authority. Also 2 year Business Courses. Write for free catalog. State course you are interested in.
TRI-STATE COLLEGE, Box E-5101, Angola, Ind.


This seems to offer some help in explaining the difficulty experienced in answering the question—"What is an engineer?" FREEMAN F. BURR.
*Canton, N. Y.*

# BY THE WAY

## Nitroglycerin as a Lubricant!

USING nitroglycerin as medicine, or to oil squeaky wheels of a cart, may sound like madness to the modern explosive expert, yet that such was actually the case is revealed by Ragnar Sohlman and Henrik Schuck in "Nobel: Dynamite and Peace," published recently. The authors point out that in actual fact Nobel's invention of explosive capsules and detonating charges for high explosives should be ranked in importance decisively above the invention of dynamite.

"The explosive oil was consigned in zinc cans, which were placed in wooden crates. These crates were at first stuffed with shavings from sawmills, and later with kieselguhr. As in the early days the nitroglycerin was not fully free of acids, the liquid often ate holes in the cans on long journeys, and ran out.

"In northern Germany nitroglycerin was at first often carried in such tin cans for considerable distances, on rough, two-wheeled carts, and when the cans began to leak it often happened that the oil trickled over the wheels, and during the winter it might even freeze. One one occasion, when the wheels of the carts began to squeak unduly, nitroglycerin was actually applied as a lubricating oil"!

Lieutenant Adelskold, who conducted some experiments with Robert Nobel, carried two bottles of nitroglycerin in his traveling case, which was thrown on top of the post and jolted there all night. One of the bottles broke during the journey and trickled over the side of the coach.

Later, when Adelskold was ready for the experiment, he looked for the remaining bottle but failed to find it. Upon searching, he found the bottle, half empty, in the corner of the woodshed. His old woodcutter, believing the nitroglycerin was grease, had used it to oil his boots and breeches!

## Just Politics

OUT of the verbal guile and the strategy that enter into politics there emerge many amusing stories, not the least entertaining of which is that told of the late impetuous and beloved Theodore Roosevelt:

On the occasion of his promoting Assistant Secretary William Loeb [now vice-president of American Smelting & Refining] from assistant to the full secretaryship, a luncheon was given in honor of the event. President Roosevelt was called upon to make a speech. He arose and, making the usual dental display, said:

"When I originally chose Mr. Loeb for a secretarial job, while I was

Governor of New York, I did not ask where he came from, nor what his nationality, his religion or his politics were. I asked where I could secure the young man best fitted for the duties that devolved upon that confidential and important position. And I found him!"

Great and emotional applause.

The next person called upon was the venerable Jacob Schiff, whose impaired hearing had prevented his understanding a word that had been said.

"I am highly honored," he said, "by being included in this company today. Also, I feel that I may, without presuming, claim to have had some slight influence in selecting the young man. For, when Colonel Roosevelt wrote me asking me to name the most influential young Republican Jew I knew, I unhesitatingly recommended Mr. Loeb."—*Collier's.*

## Strange Things Can Still Happen in the Wild West

A METALLURGIST of Salt Lake City and Los Angeles recently stopped for oil and gas near a small town in Nevada. A mine in the vicinity was attracting attention at the time, and he asked the genial and evidently loquacious individual who furnished him his petrol what metals the ore contained.

"Oh, gold and silver, and lead, and albumen, and —" his informer replied.

"Albumen?" queried the metallurgist, "Don't you mean aluminum?"

"No. The company said albumen."

"What kind of analysis was it? Urinalysis?"

"No, not mine. The company done it theirselves."

The metallurgist has informed the U. S. Bureau of Mines, which is considering sending a rescue and first-aid crew to the mine, which is evidently in the last stages of nephritis. Most of the intermountain mining companies have volunteered their aid, to prevent the spreading of the ailment among the mines of the Southwest and the consequent destruction of the industry.

## Makers of Wheelbarrows Yield to Standardization

THE wheels of economic progress have rolled up to the Wheelbarrow Association of America, according to The Associated Press. Meeting in annual session, the members—all ten of them—decided that such being the case they would climb aboard the bandwagon of standardization.

They agreed that the production of 168 different types, ranging from the old-fashioned wheelbarrow of barnyard recollections to the most refined models of metropolitan pushcarts, was a wasteful practice in this age of efficiency and speed. The number of models, they thought, can be reduced to 22, and still supply modern needs.

## Nickel May Also Be an Essential Food Element

TRACES of nickel have been found in several human foods by Professor Hans Kaufmann and Professor Oskar Keller, of the Pharmaceutical Institute of the University of Jena. The amounts are expressible only in millionths of a per cent by weight, but may be of medical significance, since nickel is usually considered an element deleterious to human health, which must be eliminated from the system. However, if minute amounts of certain metals are needed by all animal tissues, as some chemists claim, this may be the source for the body's nickel supply.

The two German chemists were led to their researches by the question of the possible harmfulness of nickel in margarine. This food fat is made by passing hydrogen through vegetable oils, in the presence of finely divided nickel which serves as a catalyst, or chemical matchmaker, to secure the union of the hydrogen and the oils. By testing high-grade margarine with the most delicate of known chemical methods, percentages of nickel from five ten-millionths to one millionth by weight were detected.

But when the experiments turned their attention to butter, they were surprised to find that good grades of this product contained more nickel than was in their margarine samples. They then analyzed various fodders eaten by cows, and again found nickel.

The highest concentrations of nickel in plants were found in the legume, or pea family. Peas and beans showed percentages as high as two hundred-thousandths.—*Science Service.*

# Consultation

## Quotations on Zircon

A correspondent in South Africa, whose signature is indecipherable, requests information in regard to alleged quotations he maintains were given in *Engineering and Mining Journal*, issue of Feb. 9, 1929, as follows:

"Zircon ore, at $40@$45 per ton.

"Zircon metal, at $1.50 per pound."

Reference to the issue in question, however, discloses the fact that the actual quotations were as follows:

"Zircon ore—Per net ton containing 55 per cent $ZrO_2$, f.o.b. Atlantic seaboard, $40@$45 in 30-ton lots.

"Zirconium metal—Per ounce, 98 per cent grade, $1.56 in 5- to 10-lb. lots."

Zircon is not a metal, but a silicate of zirconium, with the formula $ZrSiO_4$. It forms one of the commonest accessory minerals in granite and syenite. According to Ulick R. Evans, in "Metals and Metallic Compounds," "When igneous rocks containing zircon undergo weathering, the zirconium mineral remains comparatively undissolved, and is either left behind in the residual deposit or is carried off by the water in suspension. Since, however, zircon is much heavier than the majority of the insoluble minerals occurring in rocks, it is dropped comparatively readily in the running water, along with the coarser sand particles. Thus the forces of Nature bring about a considerable concentration of the zircon, and, in the same way of brazilite. These alluvial deposits are naturally a convenient source of zirconium compounds. Important deposits occur in the Caldas region of Minas Gereas (Brazil) and also in Ceylon. . . . Zircon is by far the commonest zirconium mineral in the alluvial deposits, but the oxide is industrially more useful, and is consequently more sought after. In Brazil pebbles occur in certain alluvial deposits consisting of a material called 'zirkite,' which is a mixture of brazilite with zircon and other silicates. The pebbles contain over 90 per cent of $ZrO_2$, whilst other forms of zirkite found in the same district carry about 80 per cent."

Our correspondent refers to a deposit in Africa containing 0.5 to 2.5 zircon. It would not seem practicable to develop this so as to compete successfully with the higher-grade deposits found elsewhere.

## Payment for Silver in Zinc Concentrates

*"A custom refiner in Europe has submitted a proposal for treating zinc concentrates, under the terms of which he agrees to pay for the silver content of the zinc concentrates on the following terms: 'Total silver less 5 oz. per ton to be paid for at one-half the London Standard silver price.' Under the above contract what is the amount realized per ton in U. S. currency under the following conditions: silver content of zinc concentrate 12.836 oz. per ton; London Standard silver price, 26.7708d.; sterling exchange, $4.84625; also please show formula used in arriving at silver paid for."*

Under the above conditions as to exchange and London price, the value per ounce of silver in U. S. currency would be $0.54013 per ounce. The following formula may be applied: $R = (C\text{-}5)\frac{P}{2}$ where R is the return per ton of concentrate, C is the silver content in ounces per ton, and P is the London Standard price of silver per ounce (U. S. currency equivalent in this instance). Substituting in the above formula, we have $R = (12.836 - 5.0)\frac{\$0.54013}{2} = \$2.116$, the gross amount realized from the silver content per ton of concentrate, under the contract terms.

# INDUSTRIAL PROGRESS

## Land Dredger of Bucket Ladder Type Used for Stripping in Germany

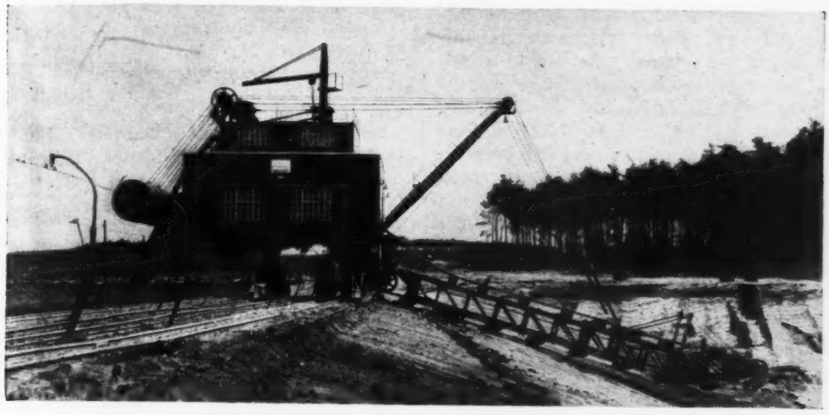


*Fig. 1—Digs from below and loads on two tracks*

STRIPPING of ore and coal lands is effected in Germany by means of equipment that is quite different from that commonly used in the United States. Machines of the land-dredge type, such as are shown in the accompanying cut, are widely used for this purpose on the other side. The equipment illustrated is a bucket scraper excavator or ladder dredge, the German term for it being "eimerbagger," meaning a "bucket dredge." How extensive the use of this machine in Germany is may be seen from the fact that about 151,000,000 tons of brown coal, as well as the overburden, was excavated in 1927 by machinery of this type.

A land-dredge manufactured by the Lubecker Maschinenbau Gesellschaft, of Lubeck, Germany, is shown in Fig. 1. This dredge runs on rails, but may be had equipped with a caterpillar mounting. As can be seen from the illustration, two tracks pass through the superstructure, and the material excavated is delivered at a point over one or the other of the tracks, as the occasion may demand. Operation is continuous as to excavating and loading. As soon as one train has been loaded, the flow of material from the buckets can be diverted to the train on the adjacent tracks. The buckets are of approximately 25 cu.ft. capacity, and when the ladder is inclined at an angle of about 50 deg. they can reach and excavate to a depth of 82 ft. vertically. The dredge shown has a capacity of 1,000 cu.yd. per hour, with buckets full and no delays. In this machine the excavator stands on forty-eight wheels, its weight being distributed by a patent three-point suspension. To counterbalance the weight of the bucket ladder, a movable counterweight is provided which runs automatically up and down on a highly inclined curved track back of the excavator. Depth of excavation can be regulated by changing the angle of the bucket ladder.

Fig. 2 shows an excavator, also made by the Lubecker company, which requires only a single track, the buckets having a capacity of about 0.4 cu.yd. The machine shown is digging from above, but with trifling changes can be converted to work upward as well.

Another machine, which weighs about 253 tons, has been operating on three caterpillar trucks. This can negotiate curves readily, and, like the machines that run on tracks, will dig either up or down the slope. The buckets have a capacity of 0.4 cu.yd. and the capacity of the dredge without delays, and with full bucket loading and discharge, is about 650 cu.yd. per hour.

Land dredges running on caterpillars are now being built with buckets of ½-cu.yd. capacity. These will excavate to a depth or from a height of about 55.8 ft., the working weight being about 462 net tons.

Spoil-disposal machines have been designed which pick up their spoil and take it down a slight inclination or on a level to the edge of the fill. The road on which the cars arrive from the strip pit passes through an opening in the

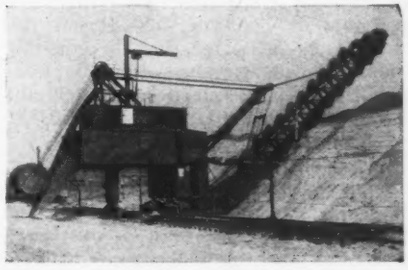
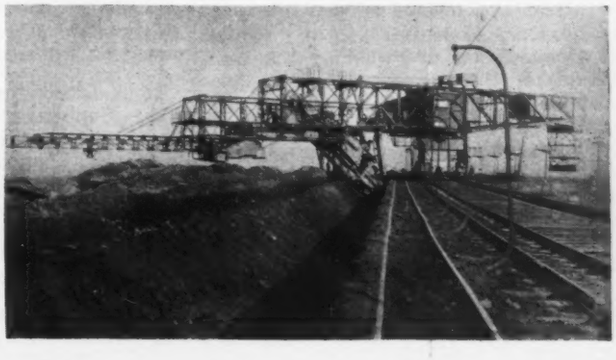


*Fig. 2—Digs from above and with varying overburden*

*Fig. 3—Conveying overburden from receiving trench to point well beyond edge of dump*

*Fig. 4—Disposal machine with bucket ladder and conveyor slewable 40 deg. either way*



machine, so that the spoil removed can be dumped at the exact point desired. The conveyor used for the transport of the material to the edge of the dump may have either buckets or scrapers. In operating the machine, the angle to the horizontal at which it works can be regulated at will. The use of such a conveyor makes it possible to keep the cars, locomotive and the machine itself away from the edge of the dump.

# Huge Electric Generators Made Possible Only Through Welding

THOSE enormous electric generators that provide American industry and homes with light and power are possible only because of the very power they produce. They make electricity, and it is because of electricity that the manufacturers are able to construct them. Development of electric welding is largely responsible for the revolutionary advances that have occurred in the mechanical construction of generators and other pieces of apparatus of comparable size. Until this method was made efficient, the makers of large generators had to cast the metal in molds, with consequent chances for imperfections. Now the machines are assembled in pieces and welded together by electricity, assuring a job that is one complete piece.

Advances in this art are of particular importance to the copper and other metal industries because of the large amounts of these materials that are necessary in construction. It has recently been estimated that, in general, machines aggregating 100,000 kva. would have approximately 150,000 lb. of copper as compared with 1,550,000 lb. of steel.

Insulating material, the kind depending on voltage and operating conditions, varies from 0.1 to 0.2 lb. per kilovolt-ampere. As most of the large generators are now being made of fabricated steel, little cast iron is used. The steel for mechanical parts includes the magnetic material such as rotor and stator punchings.

This method of construction has been investigated by the National Electric Light Association, the official group of the light and power companies of the country, for the reason that the power companies are the ultimate users of this sort of equipment. In a recent report prepared by a committee of the association, one of the member companies is quoted as follows:

"There are several reasons for the recent tremendous increase in the use of structural steel and welding as a substitute for the use of castings. The cost of constructing patterns and the expense of storing them, the loss occasioned by defects in the castings, and the likelihood of failure in service as a result of internal strains, blowholes, and the like, are some of the disadvantages of the old method of construction. They have long been appreciated by the industry and have been tolerated only because of the fear that some other form of structure would give rise to other troubles of even more serious nature.

"With the development of flame cutting of steel plate and with the increased knowledge of the art of welding, however, the designers have become convinced that steel plate will not only eliminate casting defects but will also produce better mechanical structures. In fact, factory tests have demonstrated that the new method of construction eliminates the disadvantages of castings, and produces a structure superior in strength and reliability to the cast structure."

## INDUSTRIAL NOTES

The Roessler & Hasslacher Chemical Company announces the removal of its New York City offices from 709 Sixth Ave. to 10 East 40th St.

The Wagner Electric Corporation announces the appointment, effective May 1, 1929, of L. G. Tandberg as branch manager of its Los Angeles sales office, 1220 South Hope Street.

Cutler-Hammer, Inc., of Milwaukee, Wis., has established a warehouse at Cleveland, where a complete line of standard motor control equipment and wiring devices will be available for immediate shipment.

Contract for the cells, with their foundations, for the new electrolytic department of the Nichols Copper refinery, under construction at El Paso, Tex., have been let to the Cement-Gun Construction Company, of Chicago, which has for several years made a specialty of concrete electrolytic cells.

In the issue of May 25, on p. 834, reference was inadvertently made to an apparatus used for delivering cement in connection with arch concreting as a "cement gun." This term is a trademark of the Cement Gun Company, and can therefore properly be used only in connection with its products.

Announcement is made of a merger of the Manhattan Rubber Manufacturing Company, of Passaic, N. J.; the Raybestos Company, of Bridgeport, Conn.; and the U. S. Asbestos Company, of Manheim, Pa. The operations of each company will be conducted by the present officers without changes in personnel or management.

The Canda Gayley Steel Corporation, recently incorporated to take over the business of the Chrome Steel Works, has changed its name to Chrome Steel Corporation. The operations continue to be at Chrome, N. J. Sidney C. Myers, of San Francisco, who was representative of the Chrome Steel Works for many years, will be Western representative for the new corporation.

## PATENTS

SEPARATOR. No. 1,714,171. May 21, 1929. A. F. Jobke, Pittsburgh, Pa.
*A magnetic separator of the drum type.*

CLASSIFIER. No. 1,714,007. May 21, 1929. W. E. Endrezze, Butte, Mont.
*Design for a classifier of the trough-spiral-conveyor type.*

CRUSHING MACHINE. No. 1,712,369. May 7, 1929. L. P. Walker, Belmont, Mass.
*Design for a crushing machine of the gyratory type.*

HOISTING INDICATOR. No. 1,712,045. May 7, 1929. I. W. Macy, assignor to The Galion Iron Works & Manufacturing Company, Galion, Ohio.
*A dial hoisting indicator.*

**Rock Drills**

No. 1,711,811. May 7, 1929. F. W. Rudlin, assignor to Ingersoll-Rand Company, Jersey City, N. J.
*A valve for rock drills.*

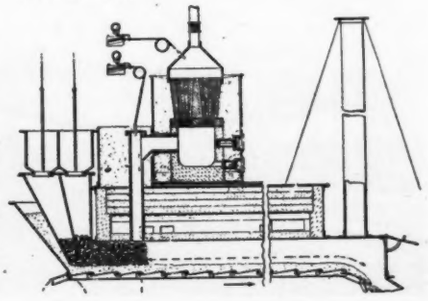
No. 1,712,239. May 7, 1929. R. H. Wilhelm, assignor to Ingersoll-Rand Company, Jersey City, N. J.
*A front head for rock drills.*

CONCENTRATOR. No. 1,712,589. May 14, 1929. A H. Stebbins, Los Angeles, Calif.
*A design for a concentrator of the classifier type.*

EXTRACTION OF ZINC. No. 1,712,638. May 14, 1929. C. J. G. Aarts, The Hague, Netherlands.
*A process for the extraction of zinc from its oxide compounds by means of a fused iron bath and the addition of carbon to the bath.*

VIBRATING SCREEN. Nos. 1,713,143-4. May 14, 1929. G. A. Overstrom, Pasadena, Calif.
*Designs for vibrating screens.*

REDUCING ZINCIFEROUS MATERIALS. No. 1,712,134. May 7, 1929. F. G. Breyer and E. H. Bunce, assignors to The New Jersey Zinc Company, New York, N. Y.
*A porous charge of agglomerates of mixed zinciferous and reducing materials is passed through a horizontal and externally heating reducing chamber. The charge of agglomerates is supported on a bed of fines carried by a traveling conveyor with a layer of coarse material between the fines and the agglomerates. The compounds of zinc in the agglomerates are reduced and the resulting metallic zinc is volatilized.*



# Personal Notes

**Guy C. Riddell** has returned to New York City from Venezuela.

**Frank M. Estes,** engaged in mining operations in Mexico, is in New York on a brief business trip.

**A. H. Hubbell,** associate editor of *Engineering and Mining Journal,* has returned to New York.

**Arthur W. Gray** has joined the staff of the Brown Instrument Company as associate director of research.

**Wharton Sinkler** has been elected a director of Tonopah Belmont Development, succeeding **George F. Tyler,** who resigned.

**F. H. F. Hampton,** managing director of Robins Conveyors, Ltd., with headquarters at Johannesburg, is on a visit to London.

**W. B. Daly,** general manager of mines for Anaconda Copper, recently returned to Butte after spending six weeks on the West Coast.

**G. L. Bevan,** of London, has been elected a director of Chibougamau Prospectors, Ltd., to represent English stockholders in the company.

**Spencer Penrose,** mine operator, of Colorado Springs, is returning to Colorado after an extended trip through Europe with Mrs. Penrose.

**Harold S. Carpenter,** who is in charge of operations at the Arizona Magma mine, at Chloride, Ariz., was married to Miss May Lindsay, of Big Springs, Tex., recently.

**G. A. Joslin** was in New York recently, after a four months' trip on mining exploration work in Nicaragua. Mr. Joslin has returned to his office in Los Angeles.

**Enoch Perkins,** mining engineer, of Noumea, New Caledonia, is returning to the United States in July for a holiday. He expects to be in New York City in August.

**S. G. Blaylock,** general manager of Consolidated Mining & Smelting, is now in eastern Canada, where he will remain for about three weeks before returning to Trail.

**L. G. Weeks** will spend the summer on the west coast of Hudson Bay, where he will make a detailed study of the mineral occurrences for the Canadian Geological Survey.

**E. T. McKnight,** of the U. S. Geological Survey, left Washington on June 1 for Yellville, Ark., to continue his study of the lead and zinc deposits of the Yellville quadrangle.

**J. D. McKenzie,** manager of the East Helena plant of American Smelting & Refining, has returned to Helena after holding a conference with company officials at Salt Lake City.

**Daniel Franklin Higgins,** lecturer in petroleum geology at Northwestern University, has been appointed professor of geology at Lincoln Memorial University, Harrogate, Tenn., for the year 1929-30.

Dr. **J. J. Sederholm,** director of the Geological Survey of Finland, received the honorary degree of Doctor of Laws at Queen's University, Kingston, Ont., at the spring commencement exercises.

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**Marcus T. Lothrop,** metallurgist, has been elected president of the Timken Roller Bearing Company, of Canton, Ohio, succeeding **H. H. Timken,** who becomes chairman of the board. Mr.

M. T. LOTHROP

Lothrop started with the Timken company in 1911 as metallurgist, and for the last eighteen years has been intimately connected with its affairs. During that time he has occupied various positions in metallurgy, research, in charge of operations, and for the last few years as vice-president and general manager.

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**Victor G. Hills** left Cyprus on June 7 and is expected in New York about July 15. He plans to make his headquarters in Denver during August, and will return to Cyprus early in September.

**Digby Burnett,** consulting engineer of the Cam & Motor, Rezende, and Sherwood Starr mines, in Rhodesia, has returned to Salisbury, Southern Rhodesia, from a visit to Australia and New Zealand.

**George H. Garrey,** consulting mining geologist, after completing surface and underground detailed geological maps for the MacNeill mine, of Tonopah Belmont Development, near Palo Verde, Ariz., has returned to Philadelphia.

**Edward Futterer,** manager of North Amethyst Mining, of Creede, Colo., has resigned his position. He will be succeeded by **Charles Hollister,** former superintendent of the Bonanza mine, of Granby Consolidated, at Anyox, B. C.

**Charles J. Adami,** of Denver and St. Louis, has been elected president of the alumni association of the Colorado School of Mines. Other officers are **Hugh Stewart,** vice-president, and **C. Lorimer Colburn,** secretary.

**W. C. Alden** is in Ashton, Idaho, where he is continuing his regional reconnoissance study of the glacial geology and physiography of western Montana, northern Idaho, and Washington for the U. S. Geological Survey.

**Burdett A. Winn,** formerly superintendent of the Lucky Jim mill, at Zincton, B. C., has been appointed superintendent of the flotation plant at the San Eligio mine of Mazapil Copper, near Concepcion del Oro, Zacatecas, Mexico.

**F. W. Bradley,** president of the A.I.M.E., was the guest of honor at the annual Engineers' Day celebration at the University of Colorado, Boulder, Colo., and delivered the principal address in Mackay Auditorium on that occasion.

**Norman Kurtz,** formerly manager of the Providencia mine, at Guanajuato, has been appointed assistant manager of the Lane Rincon mine, at Real de Arriba, near Toluca, State of Mexico, Mexico. **Blamey Stevens,** manager of the mine, is in Guerrero, examining properties for New York interests.

Sir **Robert Williams** will open the Benguella Railway on June 1. This railroad starts at Lobito Bay, on the coast of Angola, and taps the copper deposits of the Belgian Congo. The opening ceremony will take place at Luao, on the Angola-Congo border, and will be attended by many distinguished visitors from Europe and South Africa.

**Russell B. Caples,** for many years in charge of the zinc department of the Great Falls reduction plant of Anaconda Copper Mining, has been made superintendent of that plant, succeeding **Albert E. Wiggin,** who is now in charge of all reduction plants of the company in Montana. Before going to Great Falls, Mr. Caples was in charge of the zinc and copper research at the Washoe plant of the company at Anaconda.

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## OBITUARY

**Thomas Heney,** formerly connected with the Tamarack mine, in the Coeur d'Alene district, died in Spokane, Wash., on May 19, at the age of 69.

**James A. Moore,** Seattle promoter, who was interested in several mining ventures, including gold properties near Oroville, Calif., died in San Francisco on May 22.

**Crowell Beech,** graduate of the Michigan College of Mining and Technology, who was engaged in mining in Arizona several years ago, died in Los Angeles on May 26. He had left the mining industry about eight years ago.

**Louis Bolduc,** president of the Wisconsin Mining Company, in the Coeur d'Alene district of Idaho, died at Wallace on May 23. Mr. Bolduc was 77 years old and had been engaged in mining in the Coeur d'Alene district since 1883.

**Chester Huntington,** vice-president of the Huntington Aircraft Corporation, who had practiced as a mining engineer previous to his entrance into aviation, died at Stratford, Conn., at the age of 86 on May 31. Mr. Huntington was a graduate of the Columbia School of Mines, and as a consulting engineer had been interested in the mining industries of Mexico and California.

# Book Reviews

GEOLOGY OF GOLD. *By E. J. Dunn. London: Charles Griffin & Company, Ltd. Pp. 469. Price $10.*

THIS is an amazing book—amazing for the wealth of illustrations, comprising 253 halftone cuts and 172 line drawings; 135 of the halftone cuts are photomicrographs, and the remainder are reproductions from photographs of museum specimens of gold ore and country rock from various properties described in the text. The line drawings are diagrams in section and plan of reefs, veins, mines, and workings mentioned in the text. The book is amazing also because of the startling but ingenuous theories of petrogenesis and gold accumulation set forth by the author. It includes 254 pages of text, divided into 22 chapters. Thirty-three pages immediately following the text are devoted to descriptions of the illustrations, which are all grouped together at the end of the book and placed after the index.

The first chapter contains a very brief discussion of "The Earth's Crust"; the author endeavors to emphasize the ceaseless changes going on within it. In Chapter II the country rocks are described and startling ideas as to the origin of granite are pronounced. Thus, in referring to "granitic outcrops" of different ages in Victoria, the author says (pages 11-12):

"While the aspect of some of the granitic masses suggests an igneous character, there are other areas in which the change from ordinary slates and sandstones into schist, from schist to gneiss, and from gneiss to granite, is so pronounced, yet so gradual, that it is not possible to form any other opinion than that the granitic rock is the result of alteration of sedimentary material. . . . Such areas are so common . . . that there is no avoiding the conclusion that a great deal of granite rock is simply altered sediment."

The author further states that it "cannot be accepted" that granite is an igneous rock of similar origin to known igneous intrusives and effusives. Realizing the difficulty of making granite, however, from ordinary sandstones and shales whose compositions are unsuitable for that particular purpose, the author naïvely turns to the "view now held by Rutherford and other physicists," and calmly calls electrons to his aid, thus, on page 13:

"if . . . all matter consists of electrons in various combinations, the difficulty presented by great masses of sandstone, etc., with a deficiency of other essential constituents of granite, might be overcome if the atoms rearranged themselves into lime, potash, alumina, etc., so as to supply the constituents required."

The rest of the chapter is descriptive of the distribution of various sorts of country rock in the different gold fields discussed. The mind of the reviewer was much confused, however, by the subject matter of this chapter, because in some places the author writes of "granitic dykes" that penetrate adjacent sedimentary beds and the "metamorphic influence of granite," although the igneous origin of granite is denied.

In Chapter III "fissures, faults, lodes and dykes" are discussed. Although the author has made no new contributions to the literature on the mechanics of these structures, they are treated in connection with the way in which they affect the areas described and to that extent the subject matter of the chapter is of interest. Mr. Dunn seems to be something of a catastrophist, for he believes that in order to fulfill "all the conditions in which dykes occur the injection of the igneous matter must have been instantaneous." And in describing faulting at Mount Lyell mine, Tasmania, where one wall of the orebody consists of vertically dipping conglomerate, the statement is made that "the conglomerate has been hurled down bodily for hundreds of feet. . . ."

In Chapter IV "quartz reefs, or lodes and veins" are briefly treated; Chapter V is descriptive of "indicators," or key-beds, and Chapter VI contains five pages; two descriptive of conglomerates, more especially the Rand Conglomerate; the remaining three make brief mention of "metalliferous and other lodes containing gold, silver, lead and other ores."

Mount Morgan, Queensland, which "holds the premier position among gold mines of Australasia," is described in Chapter VII. The primary ore of Mount Morgan is cupriferous pyrite distributed in "a network of silica"; it carries 2 to 3 per cent of copper and a few pennyweight of gold per ton. The gold was "won from a remarkable and unique body of oxidized ore, secondarily enriched." In explaining the origin of this body of the "surface deposit of secondary origin" the author says:

" . . . through subsidence, the country rock and the sulphide ore with a thin crust of oxidized ore sank below the level of the sea or lake, . . . and as this (the sea) spread over the area occupied by the pyritic ore violent reactions were set up; the sulphides were attacked, much heat developed, and the escape of gas caused much commotion in the water. . . . the iron and copper pyrite were completely dissolved and the metals gold, silver and copper also." (Pages 75, 76 and 77.)

The gold was then precipitated with the iron, which was precipitated as limonite; but the silver and copper escaped precipitation. Under the title "metasomatic gold," Chapter XIV, the author refers again to Mount Morgan, explaining that it

"affords direct evidence that on the oxidation of the sulphide ores the gold became soluble, for it was leached out of the underlying sulphide ore and rose up into the secondary enriched ore which made Mount Morgan famous as a gold producer. The migration in this case was on a grand scale, as tons of gold traveled upward." (Page 136.)

The author apparently believes that barren leached zones overlying the primary sulphide ores below and, in the case of the Mount Morgan deposit, underlying an enriched surface accumulation of gold, are products of *upward* leaching, and that gold is readily dissolved in ground water, that the solutions *rise*, and that the gold is precipitated at the surface. No attempt is made to explain the chemistry, the physics or the mechanics of such processes except by calling upon "electrons" and "electricity" to perform such wondrous work; thus, in Chapter XV, in which minerals associated with gold are discussed, and which concludes with a page on "electricity," the author states:

"Currents of electricity are continually flowing over and through the Earth's crust, passing through the rocks in all stages of development and exerting an influence that may be expressed in the formation of crystals, in chemical combinations and alterations, and in their dissolution."

By calling forth from the vasty deeps of geology such marvelous servants as "electrons" and "electricity" many wonders may, perhaps, be performed.

Chapters XVI and XVII are devoted to the forms (shapes) of lode gold (Chapter XVI) and alluvial gold (Chapter XVII), of more or less interest, but without special significance. Chapters XVIII to XXII inclusive deal with the distribution of lode gold, alluvial gold, gold in "deep leads," in "high-level leads" and in glacial deposits, bringing the volume to a close.

The book is beautifully printed, substantially bound, and attractive. The descriptions of occurrences are excellent, but the statements set forth by Mr. Dunn with respect to geologic processes are very weird indeed.

R. J. COLONY.

GEOPHYSICAL ABSTRACTS. No. 1. *Information Circular 6120, U. S. Bureau of Mines. By F. W. Lee. Washington, D. C.*

Director Scott Turner announces that this paper is the first of a contemplated series containing abstracts of articles on applied geophysics. These will be made for the most part by officials and engineers of mining and exploration companies. Many of the abstracts in Circular No. 1 are of articles appearing in Russian and German.

# NEWS OF THE WEEK

## *Summary*

*PLANS for the development of East Geduld, on the Far East Rand, have been approved by the directors of the company and a financing scheme has been proposed. Production will probably be on the basis of 2,000 tons of gold ore daily. Page 935.*

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*Canam Metals has acquired two more properties in the Tri-State district, thus adding to its already extensive holdings. Page 933.*

* * *

*McIntyre-Porcupine will start hoisting through No. 11 shaft, at its mine at Timmins, Ont., about July 1. No. 6 shaft will be shut down for repairs. Page 931.*

* * *

*Mining of the Allouez area of the Ahmeek branch of Calumet & Hecla Consolidated on a large scale has been made possible through the use of new tramway equipment. Page 935.*

* * *

*Construction of a central power plant for the Broken Hill silver-lead-zinc mines, in New South Wales, Australia, will cost about $300,000. It will furnish 18,000 hp. Page 932.*

* * *

*Treadwell Yukon and Sudbury Basin are continuing development of their lead-zinc properties in the Chelmsford area of the Sudbury district of Ontario. Electrolytic zinc plant may be built at Sudbury. Page 930.*

* * *

*Wages in the Western copper mines have been reduced again, effective June 1. This decrease, the second since copper prices reached the peak of 24c. in late March and early April, leaves wages still 75c. a day above 1927 levels. Page 933.*

* * *

*Engels Copper will acquire a 51 per cent interest in a new company that is being formed to take over the Calaveras Copper properties near Stockton, Calif. Systematic development of the holdings will be undertaken. Page 933.*

## Low-Grade Ores May Bolster Up U. S. Gold Production, Says Survey

By Paul Wooton
*Special Washington Correspondent*

FUTURE progress in the gold-mining industry is promised through the extensive development of low-grade ores, according to a report on the nation's gold reserves which is being prepared by the U. S. Geological Survey under the direction of G. F. Loughlin. Using statistical data of the U. S. Bureau of Mines, this report, when completed, will contain a maximum and minimum estimate of gold production for the next twenty years. No sharp change is foreseen unless some unexpected factor enters the gold situation. Production will vary according to mining costs, which consideration will determine largely how extensively the low-grade deposits will be exploited.

Gold miners may be overlooking good opportunities for profitable operation at the present time, however. If copper companies can move two tons of waste for one ton of very low-grade ore, the report suggests that some of the poorer-grade gold deposits may be worthy of investigation. Although such deposits may not have been profitable in the past, the opinion is advanced that, with better mining methods coming into use, they may offer good opportunities in the near future and that they merit careful study by companies equipped to work on a large scale. A widespread sampling campaign is recommended to show whether the uniformity of gold distribution in a given area will justify large-scale operations. Much geological research also will be necessary.

Some low-grade deposits have already been worked, maintaining production through the 90's, while operating costs were low, but being abandoned when costs became prohibitive. Such mines exist in the Cripple Creek, Leadville, and Mother Lode districts. Many prospects are known where blocks of waste are so mixed with the ore as to make large-scale operations impractical under present conditions.

Mining of low-grade ore in Alaska as well as in the United States is viewed by the Geological Survey report as a steadily increasing source of gold supply. As the country develops and transport facilities are improved, heavy equipment can be moved in and mining becomes more feasible. Large-scale mining and dredging of low-grade material are already making great progress in Alaska now that the richer deposits have been taken out.

Viewing the gold situation as a whole, the report foresees that American output will hold fairly constant for the next few years, barring any large increase in copper production with coincident gold mining or any great fall of the price index putting gold more on a parity with other commodities as before the war. The outlook for dry and siliceous ores and for placers is said to point toward maintenance of the present level or possibly a gradual decline.

### Anaconda Closes Two Mines

Anaconda Copper Mining has temporarily closed its Mountain View and Anaconda mines, at Butte, Mont. The reason for closing these two properties, which are among the largest producers on Butte Hill, is stated to be the usual summer shortage of labor and the necessity for making adequate repairs. Operations at Butte are always slowed down by the approach of summer, when many of the miners leave for work on the farms. Anaconda recently announced a 10 per cent reduction in its production basis, which reached 1,000,000 lb. of copper daily at the height of the copper market.

### North Butte Hits Ore

North Butte Mining is reported to have encountered two large orebodies beyond faults on the 2,600 level of its Granite Mountain mine, at Butte, Mont. In May, North Butte shipped about 90 carloads of copper ore to the Anaconda plants from its property.

### Wright Creek Adds to Mill

To increase capacity, Wright Creek Mines is adding equipment to its 50-ton mill at the American Flag mine, near Kingman, Ariz. The new machinery consists of a 75-hp. semi-Diesel engine, a Hardinge ball mill, a Dorr classifier and a thickener. It is being installed by the Kingman Engineering Company.

## C. & H. Reclamation Work May Have Eleven Years Left

COPPER tailing at Torch Lake, Mich., will keep Calumet & Hecla's reclamation plants in commission seven to eight years more, but it is possible this may be stretched to eleven years if the conglomerate sand is not contaminated too much by amygdaloidal sand. In the rich Calumet sand bank, only an eight to ten months' supply remains. Tailing in which there is more or less amygdaloid will have to be treated then. Both the Hecla and Tamarack sand deposits are contaminated by tailing of lesser copper content. The Calumet sand bank originally contained about 18,000,000 tons of high-grade tailing, which came from the mills in the early days when metallurgical practice was not so highly developed as now.

At the Calumet & Hecla smelter, slag from the "rough" furnaces now is being reground and treated by flotation for copper. A considerable saving will result, but the percentage of copper is not enough to warrant reclaiming metal from the old slag which was dumped into Torch Lake.

## Falconbridge Shaft Now Bottomed at 1,000 Ft.

Falconbridge Nickel has completed the shaft at its property in the Sudbury district to a depth of 1,000 ft., and work is now proceeding on cutting a station at this depth. Crosscutting to the orebody will be started as soon as this work is finished. The orebody is estimated to be about 100 ft. from the shaft at this depth. Diamond drilling will soon be resumed, to determine the extension of the orebody to greater depth. Much interest is attached to this work, as a result of the copper enrichment found at depth in the Frood mine of International Nickel.

## Kearsarge Standard Operating on Two Levels

Operations at the Kearsarge Standard mine, in the Ophir-Dry Canyon district, near Stockton, Utah, are being carried on from two levels, the Kearsarge and the Bullion. Several ore exposures are being followed into limestone beds productive in the early days. The road to the mine on Shoo Fly hill is being put in condition for hauling ore.

## Abana Elects New Board

At the annual meeting of Abana Mines on May 27, a new board of directors was elected. Fred A. Kent succeeds Alfred Savard as president, Charles B. Howard replaces D. B. Rochester as vice-president, and F. I. Greenfield, Ernest Dussault, George A. Brodie, W. T. Ryan and F. G. Oke become directors in place of F. M. Connell, P. A. Vale, and Hector Authier. W. E. Segsworth, general manager of the company, has resigned.

# Treadwell and Sudbury Basin Continue Work on Complex Lead-Zinc Ores

*Drilling Proves Orebody at Errington Mine to Depth of 1,200 Ft. —Mill Recovery Improving—Local Electrolytic Zinc Plant May Be Built to Handle Concentrate*

UNDER the leadership of the Bradley interests, the outlook for the lead-zinc-silver properties near Chelmsford, in the Sudbury district, Ontario, is distinctly improving. At present, in addition to intensive development from three shafts at the 300 and 500 levels of the Errington mine of Treadwell Yukon, a diamond-drilling campaign is in progress on the 500 level. Although drill results have not been announced in detail, an official of the company states that ore has been proven to a depth of 1,200 ft.

Operations at the mill are on a basis of 250 to 300 tons daily. Lead and copper concentrates are being shipped, but the zinc concentrate is being stockpiled at Larchwood station. Some time ago, while on a visit to the property, F. W. Bradley, president of the company, stated that although several metallurgical problems had still to be solved, he believed that the company was on the right track. At that time extraction was about 60 per cent of the metallic content of the ore. Since then this has been improved somewhat. Mr. Bradley estimated that eventually extraction would be 80 per cent of the total content. Although designed primarily for experimental purposes, income from the sale of concentrate has been covering the cost of mining, milling, and part of the general overhead.

Diamond drilling, which has been carried on continuously at the adjoining Sudbury Basin property for the last two years, has indicated a large amount of ore, the character and grade of which corresponds closely to that found on the Errington mine. Sudbury Basin holdings include the entire bed of Vermilion Lake and cover the projected strike of the Errington ore zone for a distance of more than five miles. No attempt has been made to estimate the tonnage of ore indicated by the drill holes, placed 50 or 100 ft. apart. A continuous length of ore of 1,500 ft. has been indicated, however, to a depth of at least 500 ft. Two drills are now working on the south shore of Vermilion Lake, partly to determine the geology and partly to attempt to find extensions of the orebody. Widths of known ore at Sudbury Basin range from 20 to 70 ft.

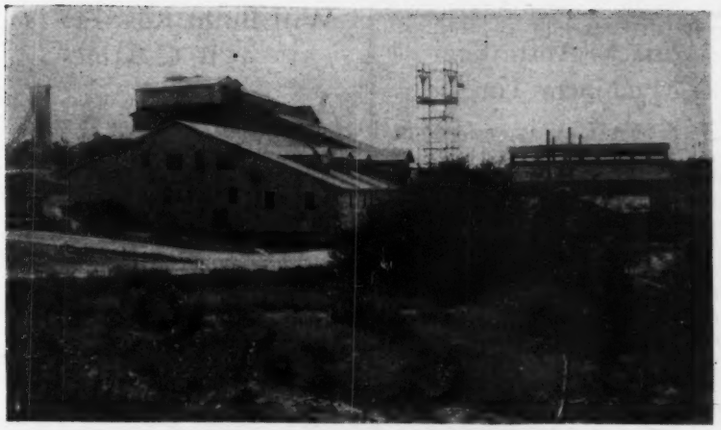
Sudbury Contact Mines is the only other property on which work is being done in this area. A surface crew is now working there. It adjoins Sudbury Basin on the south.

In addition there is the Lake Geneva property, at Geneva Lake, which is outside the Sudbury district proper. Towagmac Exploration now has this property under development. Ore was encountered on the 235 level of the property at a distance of 170 ft. from the shaft and was followed for a length of 130 ft. Ultimately this property may have an output of 100 to 200 tons of concentrate per day, which added to the probable production of Treadwell Yukon and Sudbury Basin emphasizes the possibility that an electrolytic zinc plant may be in order for Sudbury.

The chief objection to Sudbury as a site for a zinc plant has been the absence of reasonably priced power. An electrolytic zinc plant would require considerable power. Early this year the Ontario government took an initial step in solving the power problem by acquiring control of Wahnapitae Power, which it proposes to make the first link in a chain of power developments throughout northern Ontario to serve mining and industrial developments. Another factor that points to construction of an electrolytic zinc plant at Sudbury is that when Consolidated Mining & Smelting and Ventures, Ltd., announced decision to build a copper refinery, its officials also stated that they would build a zinc plant. Subsequently these two companies joined with International Nickel and American Metal to construct a copper refinery, and apparently the zinc plant was forgotten. However, Ventures, with its manifold interests, notably Sudbury Basin and Sherritt-Gordon, will probably need a zinc plant for its controlled output, and Sudbury, with its additional sources of zinc-concentrate supply, would seem a logical location.

## British Columbia to Survey Railroad Subsidy Lands

IN CONNECTION with the Dominion government, the Canadian Pacific, and the Canadian National, the British Columbia government has announced its intention to start immediately on a systematic survey of the Pacific Great Eastern Railway subsidy lands, by which is meant those lands that have been set apart by the provincial Legislature to assist in the sale or operation of the Pacific Great Eastern Railway. The whole survey will be under the supervision of C. R. Crysdale, who has been specially engaged by the government for this purpose. R. W. Brock, former director of the Canadian Geological Survey and now dean of the faculty of science at the University of British Columbia, will undertake the geological and mineralogical part of the survey, assisted by other members of the faculty. The object of the survey is to find the mineral, timber, and water-power resources and the agricultural possibilities of these subsidy lands.



*Below—The new No. 11 shaft of McIntyre-Porcupine Mines, at Timmins, Ont. Above—The McIntyre mill, which handles about 1,500 tons daily.*

## McIntyre's No. 11 Shaft to Start Hoisting Ore July 1

NO. 11 shaft of McIntyre-Porcupine, which was sunk in record time to 4,100 ft. depth at the company's property in the Porcupine district, northern Ontario, is now ready to handle ore from all parts of the mine and mill tonnage will move through it about July 1, 1929, according to R. J. Ennis, general manager of the company. This will provide an opportunity to replace timber on No. 6 shaft, which has been in continuous operation since 1912. Work near the No. 11 shaft is confined to crosscuts to the ore zone and drifts in Nos. 3, 13, and 14 veins, with good results so far on the 1,625, 1,750, 1,875, 2,000, 2,250, 2,375, 2,875, 3,375, 3,500, and 3,625 levels.

On the 3,750 level, the crosscut south showed low-grade material at points corresponding to the probable position of veins Nos. 13 and 14. No drifting has been done from this crosscut as yet, but when it is started orebodies should be developed, as indicated by results obtained on the 3,625 level.

In the basic schist area, a small amount of crosscutting and diamond-drilling from the main drives on the 3,875 level has been accomplished. To date four veins other than the ones cut by the original crosscut have been located. Drill intersections have varied from junore to well over the average grade sent to the mill. The main drives will be continued to the east and west boundary lines which are respectively 1,900 and 1,000 ft. from the points reached by these drives to date. Connections on all haulage levels have been made with No. 11 shaft and an ore pass has been completed from the loading station below the 3,875 level to the 1,625 level. Ore reserves at the property have increased slightly, and on March 31 were estimated at $16,179,205, or a little less than four years' supply.

## Will Build Pipe Line for Eagle-Picher's Ruby Mine

Construction of a pipe line, 14 miles long, from the Santa Cruz River to the operations of Eagle-Picher Lead at Ruby, near Nogales, Ariz., will be undertaken to guarantee a constant supply of water for the mill, now handling about 250 tons of lead ore daily. Mine operations have failed to supply sufficient water for continuous operation. Pumps will be installed at a point on the Baca grant, south of the Tumacacori Mission.

## New Operators to Develop Gem Merger Mines

THE Gem Merger properties at Cerbat, 15 miles north of Kingman, Ariz., have been acquired under lease and bond by E. H. Crabtree and associates. Financial arrangements are said to have been completed, and development work will start at once. The properties consist of the Golden Gem, O'Brien, Flores, and Idaho mines. The main shaft at the Golden Gem will be unwatered to the 600 level; a 500-ft. shaft will be sunk on the O'Brien property, and drifting will be done from both shafts. At the same time the vein system which traverses the properties will be explored by a series of horizontal diamond-drill holes, which will be drilled from the surface. In addition to horizontal holes a number of holes will be drilled to cross the veins at depths from 700 to 900 ft.

The Golden Gem and Flores mines are gold properties, and the O'Brien mine is a silver-lead property. The Idaho mine, although not developed to the same extent as the others, has produced some gold ore. E. H. Crabtree is in charge of operations at Cerbat, and M. C. Lake, of Duluth, Minn., is consulting engineer and geologist.

## Killed Repairing Shaft at Old Dominion

Arthur Oates, shaft repair boss at the Old Dominion mine, in Globe, Ariz., was killed on May 28 when he fell from the 700 level to the 1,800 level of the Gray shaft. Oates and his helper had been repairing shaft timbers at the 700 level, and had sounded the bell to move the cage. In some way Oates' head was caught by a timber, and he fell to the bottom of the shaft. He was born in Camborne Cornwall, England, 51 years ago, and come to the United States when he was sixteen years old. He had been a resident of Globe for 28 years.

## Moscow Silver Ships Ore From New Strike

Moscow Silver is shipping from its new strike on the 1,565 level of its property, near Milford, Utah. About 6 ft. of ore has been opened up for 30 ft. on the 1,565 level. Shaft equipment is being changed preliminary to sinking to the 1,600 level to develop the new orebody.

The company has also started a new piece of work, that of driving south on the 1,100 level to prospect the ore-bearing limestones in virgin territory, from which some production was made on the surface.

## Drive Adits at Utah State

Two adits will be driven on the holdings of Utah State Silver Mining. The property adjoins the Star of Utah and Valeo properties, in the East Park City district of Utah. Equipment is now being installed.

## Power Plant for Broken Hill Will Cost About £300,000

CONSTRUCTION of the central power plant that will serve the mines of the operating companies in the Broken Hill silver-lead-zinc district, New South Wales, Australia, will cost about £300,000. The plant will consist of six 3,000-hp. generating units and four 1,200-hp. air compressors. Completion of this plant is not expected for at least two years, as the orders for all the machinery have not yet been placed. No site has been finally decided on for construction of the plant, but it may be placed on the south side of the boundary line of the Central mine. F. J. Mars, consulting engineer for the Broken Hill companies, recently returned from Europe, where he received bids for the contract from prominent European Diesel engine manufacturers.

## N'Changa Lets Contract for 30,000 Ft. of Drilling

N'CHANGA COPPER recently entered into a contract with the Sullivan Machinery Company for an extensive drilling campaign at its mine in the N'Dola district, Rhodesia. Minimum footage to be drilled is 30,000 ft., according to F. L. Gibbs, chairman of the board of directors. Sullivan has furnished three Class "P" drills for this work which can drill to a depth of 3,000 ft., and two Class "N" drills, which can drill to 1,200 ft. Drilling crews to operate three shifts daily have been furnished also. Most of this equipment has already left for Africa, and operations will be started toward the end of July.

Mr. Gibbs, at the recent extraordinary meeting of the company, called to vote on the proposed financing scheme, stated that the estimate of ore reserves at the property on Dec. 31, 1928, was more than 31,000,000 tons, averaging 3.85 per cent copper.

## Nevada Bureau of Mines Will Begin Survey Soon

THE State Bureau of Mines created by the last Nevada Legislature will soon start two parties on the survey of the state's mineral resources as provided in the act creating the bureau. One party consisting of Dr. J. C. Jones, geologist, and Jay A. Carpenter, mining engineer, will go to the Boulder Dam area and make a thorough investigation of the mineral possibilities in that area, with the primary object of assembling information regarding the mineral industry in the southern part of the state, and a careful study of the situation will be made for the purpose of devising ways and means to utilize the power which will be available from the Boulder Dam power plants. This is considered one of the most important pieces of work that the bureau can do at this time, its object being, of course, to create industries in the Boulder Dam area that will utilize as much of the power as has been allocated to the state of Nevada. If this power can be used in the state it will increase the taxable property materially, thereby increasing the state's revenues, and it will also give the state the benefit of the payrolls and supply markets created by the utilization of this power. When this survey is completed a Bureau of Mines bulletin will be issued and will be available for free distribution to the public. When the Boulder Dam area survey is completed Dr. Jones and Mr. Carpenter will travel over the southern part of the state, investigating the mineral resources.

Another party, composed of Walter S. Palmer, metallurgist, and R. M. Oliver, will make a study of the northern part of the state, going as far east as the Utah line in the neighborhood of Ely. Messrs. Palmer and Oliver will then take in the northern part of the state as completely as possible. Both of these parties will gather as much information as possible about all of the mineral deposits, both metallic and nonmetallic, but particular stress will be laid at this time on cinnabar. As soon as these two parties have finished their survey a mercury bulletin will be written, with illustrations, and this bulletin will be available for free distribution to the public.

## Attacks Australian Machinery Tariff

H. E. VAIL, vice-president of the Chamber of Mines of Western Australia, has attacked the government's attitude toward the development of gold mining in Western Australia. He points out that Wiluna Gold, which is equipping its property to produce 1,300 tons of ore daily, is importing about £200,000 worth of machinery, which cannot be made in Australia and for which the company must nevertheless pay an import tax. Despite the recommendation of the dominion Development and Migration Commission that new machinery for mines that cannot be manufactured in the dominion be admitted free, the present government has taken no steps in this direction.

## Reno Constructing 40-Ton Mill

Construction of a 40-ton mill at the Reno gold property, in the Sheep Creek district of British Columbia, has been started. Development of the mine by the present company was started last October and ore was disclosed over a length of 200 ft. in two veins. Construction of the mill, power plant, and cable tramway at the mine will cost about $53,000, according to a recent estimate. The company has about $200,000 in its treasury.

## Will Build Roads to Isolated B. C. Mines

AS A RESULT of a conference called by W. A. McKenzie, Minister of Mines of British Columbia, tentative plans have been made for extension of existing roads for the purpose of opening up new and promising mineral areas. At the last session of the British Columbia Legislature, $100,000 was voted for this purpose, and Mr. McKenzie called the conference of resident mining engineers of the several mining districts into which the province is divided to consider the best method of using this sum.

The existing trail from Stewart, in the Portland Canal district, will be extended to connect with the old Telegraph Creek trail, thereby opening up the district that Dr. F. A. Kerr, of the Canadian Geological Survey, called the most promising mineral area in western Canada. Another important trail is planned from Mile 23, on the Hope-Princeton trail, north over the divide at the head of Soqua Creek to Jessica, on the Kettle Valley railroad, then to the south fork of Lardner Creek, from there to the Anderson River and on to unite with the Cariboo Road at Boston Bar. Other trails in the Revelstoke and Boundary districts are under consideration.

## Discon Gold Operating Sylvanite Mine in Oregon

Operations at the Sylvanite gold mine, near Gold Hill, Ore., are now being conducted by Discon Gold Mining, which acquired the property last year. A. D. Coulter is president of the company. C. C. Coulter, in our issue of April 20, was erroneously reported to be interested in the mine. In addition to the Sylvanite mine, Discon Gold holds the Dixie-Meadows and Independent properties, near Baker, Ore. Driving of a tunnel 600 ft. to strike the extension of the Sylvanite vein is now under way at that property. When this work is completed, the company expects to start operating the 100-ton mill on the ground. The Baker properties are also equipped with a small mill.

## Renews Option on Mararoa, in Western Australia

Directors of Mararoa Gold Mining have renewed the option on the company's property at Ready's, near Cue, Western Australia, held by H. E. Vail, of Kalgoorlie. This new option is for eighteen months, effective July 1, and replaces an agreement that expired on April 18. Mr. Vail agrees to spend from £25,000 to £30,000 on development work during the period of the option. If this is exercised a company will be formed, with a capital of £300,000, in which the present owners will be given a quarter interest. Drilling has proved the extension of the orebodies to the 500 level.

## Engels Acquires Control of Calaveras Copper

AN AGREEMENT has been drawn up between Engels Copper and Calaveras Copper whereby the former company will take over the properties of the latter. A new company will be formed, in which Calaveras will have a 49 per cent interest and Engels a 51 per cent interest. In return for its share, Engels will take over the management and operation of the Calaveras property, will clear all debts now pending against Calaveras, and will provide $125,000 for working capital.

The Calaveras mine is at Copperopolis, 45 miles east of Stockton, Calif., and consists of about 3,014 acres. It has been operated intermittently since 1861. Development has already reached a vertical depth of about 1,100 ft., and about 200,000 tons of ore, assaying 3 per cent copper, is in sight. Equipment includes a 500-ton flotation plant a 200-ton smelter, and a tramway for transportation of ore from the shaft to the mill and smelter.

Engels will start systematic development of the holdings. When production is started, it will only be on a small scale, and the property will be brought to capacity as development warrants.

## Canam Acquires Two More Properties in Tri-State

CANAM METALS has closed an option of the mine of Crystal Mining, at Cardin, Okla., in the Tri-State district, thus adding to its already extensive holdings in the district. No price has been announced. The Crystal lease, consisting of about twenty acres, has been one of the most productive lead properties in the district. More than 1,000 tons of lead concentrate have been produced and shipped from this mine this year.

Canam Metals has also announced purchase of the Foch mine, near Cardin, Okla., in the Tri-State district. The property was owned by Eagle-Picher Lead, but was last operated by Evans-Wallower Lead, which disposed of its operating agreement to the Canam.

Hugh Poynor and associates have taken over the Weepah mine, south of Baxter Springs, Kan.

## Grade at Michigan Mines in 1928 Was Highest in Years

YIELD per ton of ore treated in the Michigan copper district has been increasing in the last few years, and in 1928 it was 24.239 lb. per ton of ore treated, the highest in a long time. This increase results largely from closer selection of ore underground. The average profit per pound of copper produced in Michigan during the period 1924-1928 was 1.3c. at the mines and 2.1c. at both mines and reclamation plants. The average price received was 14.01c. per pound. Labor and supplies were responsible for more than half of the cost. In 1928 the average profit was 2.7c. at mines and 3.5c. at mines and reclamation plants. The average price was 14.75c. a pound.

## Start Hydraulic Operations at Omega Hill Mining

Washing of gravel was scheduled to start at Omega Hill Mining, above Washington, Calif., about June 1. Two débris-impounding dams have been constructed under permit by the California Débris Commission and a new flume has been built on the Blue Ten ditch. It is reported that 30,000,000 cu.yd. of gravel is available. W. N. Sim is general manager, Arthur Price, engineer and T. L. Larsen, superintendent.

## Oat Hill Quicksilver Mine Now Being Equipped

Three carloads of machinery have been hauled over the mountains, 26 miles from Caliston, Calif., to the Oat Hill quicksilver property of Acme Mines & Mill. The shipment includes a 100-ton Gould furnace, 4 ft. in diameter and 56 ft. long. A tool house and blacksmith shop have been built and a 200-ton ore bin is nearing completion, under the direction of Edward Leister, superintendent of the property.

## Buy Group Near Goldfield

J. C. Bradley and Charles A. Hock, of Los Angeles, have purchased a group of gold-silver-lead claims, 45 miles southwest of Goldfield, Nev., known as the Old Shiloh mine. The owners have incorporated the Shiloh Mining & Milling Company to operate the mine, which is developed by two tunnels and two shallow shafts.

## Construction of Ardsley Butte Mill Progressing Rapidly

Construction of the Ardsley Butte mill, in the Butte district, is proceeding rapidly. Two sides of the building have been closed in and the ore bins have been completed. Two of the four carloads of machinery for the mill have arrived in Butte and will soon be installed, as the concrete has been poured and has set. The company is shipping 60 tons daily, assaying from 26 to 42 oz. of silver per ton.

## High-Grade Strike Reported at Mine Near Chloride

A strike of high-grade gold ore, 6 to 8 in. wide, in a 4½-ft vein at the Pilgrim mine, near Chloride, Ariz., is reported from Kingman. The strike was made on the 230 level of the mine. A raise is now being put up on the oreshoot. A small milling plant is in operation at the property.

## Wages Reduced Again at Western Copper Mines

AS A RESULT of stabilization of the copper price at 18c., at least temporarily, Western copper miners' wages have again been reduced 5 per cent, or 25c. per shift, depending on the location of the mine. This is the second reduction in wages since the decline of the price from the peak of 24c. a pound of copper, and follows four successive advances, totaling 25 per cent, or $1.25 per shift, depending on the location of the mine. Wages at Butte are now on a minimum wage basis of $5.50 a shift, as compared with $4.75 before Sept. 1, 1928, and a high of $6 in April. In the Arizona mines, the wages are 15 per cent above the rates in effect before Sept. 1, 1928. The new wage rates went into effect on June 1.

Although there have been wage decreases in the West and Southwest, no change has been made in wages in the Michigan copper district since the 10 per cent increase went into effect on April 1. The base rate is $4.75 for miners and trammers, but the daily wage runs considerably above that on contract, men receiving $6 to $7 per day under the bonus system.

## Geological Survey Starts Co-operative Investigations

CO-OPERATIVE geological investigations by the personnel of the U. S. Geological Survey through state aid are getting under way the summer's field season, according to reports from the Department of the Interior. In Idaho, a party is already in the field, and work in Oregon and Nevada doubtless will be started during the latter part of this month. A bill passed by the Colorado Legislature and signed by the Governor provides $40,000 for geologic studies over the two years ending Nov. 30, 1930. This will insure the continuation of present projects and will permit the scope of the Colorado work to be enlarged.

## Arrowhead Driving Tunnel

A portable Chicago Pneumatic compressor has been installed at the property of Arrowhead Metal Mining in the Gilson Mountains, 30 miles south of Eureka, Utah, and 7 miles from Lynndyl. An inclined shaft has been sunk on an ore showing that appeared to be making into the limestone beds. A tunnel is being driven to open up this showing.

## Mohawk Maintains Output

Mohawk is maintaining average shipments of copper ore of 2,000 tons per day from its three operating shafts, in the Michigan copper district. No. 6 shaft is providing more than the other two combined. No. 1 is shipping 500 tons, No. 5 300, and 1,200 tons is coming from No. 6.

## Basin Montana Storing Ore From Grey Eagle Mine

BASIN MONTANA TUNNEL is storing ore from its Grey Eagle mine, near Basin, Mont., and the ore bin now contains about 150 tons, according to Samuel J. Barker, Jr., managing director of the mine. This material was extracted mainly from the raise 100 ft. east of the winze on the tunnel level. A crosscut and another raise are being started about 100 ft. further east, and ore will be extracted from these workings also. The 500 level, 100 ft. below the tunnel level, is being opened and stoping will soon start at the point. New guides are being put in the winze and a new cage is on the ground.

Financing of the 16,000-ft. tunnel which will be driven to cut the vein south of the Grey Eagle vein has been assured by a contract which provides for the sale of 1,000,000 shares to a group of financiers.

## Splendid Progress Made in Mine Safety Work

RECORDS achieved by several mines and quarries in operating over long periods of time without injuries to employees or with remarkably low accident rates, while participating in the National Safety Competition held during 1928 under the auspices of the U. S. Bureau of Mines, are characterized by Secretary Lamont of the Department of Commerce as "a definite and substantial contribution to safety in industry in the United States," in congratulatory letters addressed to the participating companies. Three large iron mines in Michigan, an Oklahoma zinc mine, a Kansas zinc mine, three non-metallic mineral mines in Ohio, Missouri, and West Virginia, and 34 quarries and open-pit mines in Alabama, California, Indiana, Kansas, Michigan, Missouri, New Jersey, New York, Ohio, Pennsylvania, Texas, Virginia, and Washington were operated throughout the year without a single accident involving loss of working time by an employee. About 280 mines and quarries, located in 35 states, were represented in the contest. Total amount of exposure to hazard was more than 91,000,000 man-hours. Commendatory letters were written by Director Scott Turner, of the Bureau of Mines, to mines and quarries awarded honorable mention.

First place in the metal mine group was given the Berkshire iron mine of the Brule Mining Company, Stambaugh, Mich. This mine employed an average of 177 men, working 403,487 man-hours, without a single loss-time accident. In this group, honorable mention was given the Rogers iron mine of the M. A. Hanna Company (Munro Iron Mining Company), Iron River, Mich., and the Jay Bird, Webber and West Side zinc mines of Commerce Mining & Royalty, in the Tri-State district. The first three named went through the year 1928 without incurring a single loss-time accident.

The best record among mines producing non-metallic minerals other than coal was made by the Ironton limestone plant of the Alpha Portland Cement Company, Ironton, Ohio. At this plant 115,020 man-hours were worked without a single accident. In this group, honorable mention was given the Manheim mine of Alpha Portland Cement, Manheim, W. Va., which also had no loss-time accidents; the Lower Gypsum mine at Gypsum, Ohio, and No. 1 mine of U. S. Gypsum at Southard, Okla., and the North Holston mine of Beaver Products, North Holston, Va.

Among the quarries and open-pit mines, the operation establishing the best record was the Wakefield iron mine of the Wakefield Iron Company, Wakefield, Mich., which employed 125 men and worked 283,680 man-hours without a loss-time accident.

## Mining Engineers and Dog Racers of Note—Miss Genevieve Parker

MINING ENGINEERS, or prospective mining engineers, who keep their noses too closely to the grindstone do not go very far. Miss Genevieve Parker, senior at the School of Mines of the Alaska College, recognizes the truth of this precept, and takes to dog racing for recreation. The accompanying illustration shows Miss Parker with her racing team of sled dogs that last winter won the race for women drivers held at Fairbanks, entitling their pulchritudinous owner to claim the Women's Dog Racing Championship of Alaska, among other distinctions. Miss Parker also placed fourth in the Endicott Sweepstakes Race, in competition with the best men drivers of the North.

Genevieve, if we may presume to be familiar (and a glance at the illustration reassures one as to her genial nature), is working for the degree of Bachelor of Science in Geology at the School of Mines. Her father was in former years a prominent mining man in the Fairbanks district, and she has therefore had considerable contact with the mining industry.

## Nevada Central Is Drifting

Nevada Central Mining, operating 30 miles south of Beowawe, Nev., has stopped sinking its incline shaft at a depth of 300 ft. and has started drifting to fissure intersections east and west along the limestone-quartzite contact.

# Johannesburg Letter

By Owen Letcher
*Special Correspondent*

## Plans for Development of East Geduld Mine Are Being Completed

Johannesburg, April 29, 1929.—For the last two and a half years the claim area of East Geduld Mines has been under development by means of drifts carried into the property from the adjoining property on the west—the Geduld Proprietary. In this way a substantial tonnage has been proved on the East Geduld property without recourse to shaft sinking. A similar method of exploration has resulted favorably on the property of Daggafontein Mines, which has been developed through the workings of the Springs property. By this method, production can be reached much more quickly, as ore can be blocked out while the producing shafts are being sunk and the reduction plants are being constructed.

INITIAL developments at East Geduld have been sufficiently encouraging to induce Union Corporation, which controls the company, to outline the plans for shaft sinking and mill construction. At the end of March the main incline had been extended 3,218 ft. into the property, which consists of 2,641 acres under lease. In all, 35,643 ft. of development work had been completed, of which 23,960 ft. was on the reef. Assay results from samples on the reef indicate that 10,125 ft. contains ore. The consulting engineer, after a careful examination of the areas in which development work has been done, estimates ore reserves at 1,900,000 tons of an average value of 6.6 dwt., over an average width of 56.5 in. He recommends that a vertical shaft be sunk without delay and that, subject to development work continuing to give satisfactory results, a decision be made on construction of a mill soon enough to permit completion of its construction at the same time as the mine is in a position to enter production.

Cost of sinking and equipping a vertical shaft, together with the additional development work needed to bring the mine into production, is estimated at £918,000. Cost of constructing a mill to handle 2,000 tons daily is estimated at £477,000. To these amounts, sundry expenditures must be added, which would probably bring the cost of putting East Geduld into production at about £1,500,000.

To finance sinking of the shaft, which will be started immediately, the directors have decided to increase the capital of the company from £350,000 to £1,000,000. The additional shares will be subscribed for by the Union Corporation, Ltd., or by its nominees from time to time, as funds are needed. The Union Corporation holds the right to float any additional issues of stock up to a total of £1,800,000. Some similar scheme will probably be evolved in connection with Daggafontein, and mining men on the Rand expect to see both mines in production late in 1931 or early in 1932.

R. S. G. STOKES, the new consulting engineer of City Deep, has reported that although the development position underground is improving and the general outlook of the company is bettering, no dividends can be expected this year. The large monthly losses registered by City Deep last year and throughout the first part of the current year have been among the most disquieting features of operations in the Central Rand. City Deep is the Witwatersrand's second deepest mine, being outrivaled in this respect only by its neighbor on the east, Village Deep.

R. C. Warriner, when he was with the controlling group, the Corner House, proposed several years ago to operate and develop the mine in much the same manner as Crown Mines, but his development program was not adopted. The Crown Mines scheme was a far-seeing one. Deep verticals were located "out in the blue" to cut the reef in depth at a later date, and the policy adopted at this property has been fully justified by the results secured. On the other hand, City Deep has always been a difficult property to operate, and when the grade of ore fell off several months ago the mine entered into a period of unprofitable operation.

## C. & H. Prepares to Mine Allouez on Large Scale

PREPARATIONS are being made to mine the Allouez area of the Ahmeek branch of Calumet & Hecla, in the northern part of the Michigan copper district, on a large scale. This will be made possible by the use of new tramway equipment of large capacity. Stoping in Allouez ground is under way on No. 34 level. No. 4 shaft may be closed this year, and the ore remaining in its territory mined through the lower levels of No. 3 shaft. Costs should be lower by this operation.

No. 2 shaft on Ahmeek ground is approaching the boundary, and only a few levels remain to be opened in this part of the mine. No. 3 shaft, however, has a long career ahead, as it can go to a depth of 8,000 ft., twice its present depth. No. 2 is bottomed on the No. 41 level, and drifting is proceeding above the No. 38 level.

As operations trend to go more to the northern part of the conglomerate department, No. 3 North Tamarack shaft will be used as the supply shaft instead of No. 12 shaft, which was originally designed for this purpose. Sinking is proceeding in "C" shaft, bottomed now on the No. 94 level, and drifting is in progress on No. 81 level to connect with the "A" shaft. No. 92 level of the "C" shaft will be used for haulage.

# Toronto Letter

*By Our Special Correspondent for Northern Ontario*

## Teck-Hughes Crosscut Shows Better Results on No. 20 Level Than on No. 19

Toronto, June 1, 1929.—The crosscut on the new No. 20 level at the Teck-Hughes mine, at Kirkland Lake, has proved the ore zone to have a width of 25 ft. Of this width, the first 10 ft. assayed about $15 a ton, which is about the average grade being handled at the mill, but the balance is somewhat lower. Results in this crosscut are somewhat better than those obtained in the No. 19 level, immediately above. The next of the six new levels to reach ore will be the No. 25, which should enter the zone some time next week.

RUMORS have been current to the effect that Lake Shore, adjoining Teck-Hughes, would not go ahead with the additions to its mill as announced, but these rumors have been officially denied. Orders for new machinery are now being placed. The first of the six new tube mills will reach the property this month and will raise mill capacity from 1,350 to 1,500 tons daily. The rest of the equipment, which will increase capacity to 2,000 tons, will be installed by the end of the year.

Diamond drilling has been started on the 500 level of the Quemont property, controlled by Mining Corporation, which adjoins Noranda in the Rouyn district. Shaft sinking has been completed to 900 ft. Drifts will be run east and west from the shaft at this level, and most of the drilling will be done at this depth.

Noranda is now earning at the rate of about $0.60 a share per quarter on the 2,241,000 shares issued. By the end of the year earnings will be greatly increased when the total effective capacity of 2,000 tons daily is reached. Grade will probably be higher than at present, because ore will be extracted from the high-grade H orebody. Annual copper production from this mine is expected to be stabilized at about 100,000,000 lb.

Shipments to the Noranda smelter will be started from the Tip Top copper mine, 80 miles west of Fort William, in western Ontario. A 6-mile railroad spur has been constructed to this property, and loading platforms and pockets have been completed. The Tip Top shipped a considerable tonnage of ore several years ago.

The first gold brick from Bathurst Mines, in the Red Lake section of northern Ontario, has been shipped out by airplane. This is the result of the first run of a two-stamp Tremaine mill. The ore came from the 250 level of the mine. Bobjo Gold recently shipped 600 lb. of high-grade ore from its property in the Patricia district, and about $5,000 in gold was produced.

# MARKET AND FINANCIAL NEWS

## Anaconda 1928 Earnings More Than Double Those of Previous Year

*Higher Copper Prices, Increased Production, and Acquisition of New Properties Feature Year's Operations*

ANACONDA Copper Mining Company reports 1928 as the most successful peace-time year in its history. Net income increased from $10,123,258 in 1927 to $24,174,780 in 1928. John D. Ryan, chairman of the board, in his remarks accompanying the annual report, states that the outstanding development of the copper industry during 1928 was the extraordinary increase in domestic consumption which developed during the second quarter and continued throughout the year. The price of copper at the beginning of the year was 13.86c. It declined to 13.675c. on March 2, and at the close of the year was 16.27c. The average for the year, as reported by the *Engineering and Mining Journal*, was 14.57c., being an increase of 1.65c. over the 1927 average price. The increase in the company's income over that of the preceding year resulted from the increased copper price and the expansion of operations.

In August the company purchased from interests representing the heirs of the late Senator Clark all of their mining, milling, and lumber interests in Montana and Idaho, together with the Butte Electric Railway Company and the Montana Hardware Company, for the sum of $4,456,824.

**Anaconda's Construction Expenditures During 1928**

| | |
|---|---|
| Butte mines | $1,250,985 |
| Anaconda reduction works | 1,253,188 |
| Great Falls reduction works | 170,994 |
| East Helena slag-treating plant | 71,677 |
| American Brass Company | 1,210,217 |
| Raritan Copper Works | 229,565 |
| International Smelting Company | 171,460 |
| Miscellaneous construction | 102,506 |
| Total | $4,460,595 |

A total of $36,857,000 par value of the $50,000,000 fifteen-year 7 per cent convertible debentures, due Feb. 1, 1938, was exchanged for stock of the company in accordance with the terms of the trust indenture, increasing the number of shares outstanding from 3,000,000 on Jan. 1, 1928, to 3,648,311 at the close of business Dec. 31, 1928. Most of the remaining debentures have since been converted. The $16,933,000 par value ten-year series "A" 6 per cent secured gold bonds due Jan. 1, 1929, were paid and retired at maturity. Butte, Anaconda & Pacific Railway Company first-mortgage 5 per cent sinking-fund gold bonds, due in 1944, were decreased to $2,250,000 by Dec. 31, 1928.

Drifts, crosscuts, raises, winzes, and shafts in the development work of the company were extended 34.60 miles, as compared with 30.67 miles during 1927. The various mining properties owned by the company produced the following tonnages:

| | Copper Ore and Precipitates | Zinc Ore | Lead-Zinc Ores | Phosphate Rock |
|---|---|---|---|---|
| Butte mines | 3,013,494 | 18,159 | ..... | ..... |
| Anselmo | 28,628 | 1,874 | ..... | ..... |
| Elm Orlu | 4,676 | 87,405 | ..... | ..... |
| Utah-Delaware | 1,879 | ..... | 114,231 | ..... |
| Utah-Delaware leasers | 31,105 | ..... | 23,545 | ..... |
| Conda | ..... | ..... | ..... | 19,882 |
| Conda leasers | ..... | ..... | ..... | 24,378 |

Production of zinc ore was limited to the amount necessarily extracted in the course of development work, because of the low zinc price prevailing throughout the year and the available tonnage of custom concentrates.

The slag treating plant at East Helena, Mont., operated satisfactorily, treating 68,127 tons of slag assaying 15.1 per cent zinc and producing 10,479 tons of fume assaying 71 per cent zinc, which was shipped to the electrolytic zinc plant at Great Falls. The plants of the company treated the following tonnages:

| | Concentrators Ore | Smelters Cuprous Material | Smelters Lead Material |
|---|---|---|---|
| Anaconda copper concentrator | 2,975,205 | ..... | ..... |
| Anaconda zinc concentrator | 416,387 | ..... | ..... |
| Timber Butte concentrator | 125,686 | ..... | ..... |
| Tooele concentrator | 427,340 | ..... | ..... |
| Rico concentrator | 33,905 | ..... | ..... |
| Anaconda smelter | ..... | 648,939 | ..... |
| Tooele smelter | ..... | 117,028 | 294,525 |
| Miami smelter | ..... | 219,401 | ..... |

Production, including purchased and toll material, was as follows:

| | Copper, Pounds | Lead, Pounds | Silver, Ounces | Gold, Ounces |
|---|---|---|---|---|
| Anaconda | 247,577,554 | ..... | 6,165,122 | 36,563 |
| Tooele | 20,654,286 | 145,613,624 | 8,439,371 | 65,117 |
| Miami | 121,746,288 | ..... | 239,748 | 6,637 |

Cathode production of the Great Falls copper refinery was 263,141,497 lb., of which 252,679,922 lb. was melted into shapes. Output of the Raritan Copper Works was 391,124,387 lb. of fine copper, 17,073,357 oz. of silver, and 157,641 oz. of gold.

The zinc plants treated 17,864 tons of ore produced by the mines of the company and 686,304 tons of ores and concentrates purchased from other producers in Montana, Utah, and Idaho, a total of 704,169 tons. The electrolytic zinc refineries at Anaconda and Great Falls produced 321,122,464 lb. of zinc, 16,303,797 lb. of zinc in dross, and residue from which there was recovered 24,524,208 lb. of lead, 2,575,697 lb. of copper, 3,887,284 oz. of silver, and 10,989 oz. of gold.

International Lead Refining Company, at East Chicago, Ind., treated 88,499 tons of lead bullion, from which there was produced 165,511,434 lb. of common lead, 7,148,635 lb. of antimonial lead, 7,805,496 oz. of silver, and 40,985 oz. of gold.

The output of manufactured products of the various plants for the year 1928 established a new high record. There was a large increase in the demand for Anaconda Brass Pipe and the various patented alloys.

During the year, International Smelting Company acquired a majority stock ownership of Park Nelson Mining Company and Park Premier Mining Company, operating in the Park City district, Utah. The last-named company holds a 51 per cent interest in Park Central Mining Company, Park Empire Mining Company, and Park Cummings Mining Company. These companies collectively own more than 5,000 acres of land in what may prove to be the easterly extension of the Park City belt of mineralization. Development of these properties will be financed by funds advanced by the International Smelting Company.

Operations at the Walker mine, in California, were continuous throughout the year. The concentrator made an average recovery of 91.294 per cent. A total of 391,275 tons of ore, averaging 1.443 per cent copper, was treated, from which 22,653 tons of concentrates, averaging 22.755 per cent copper, was produced. Sales to the smelter aggregated 22,544 tons of ore and concentrate, yielding 9,613,856 lb. of fine copper, 202,313 oz. of silver, and 13,011 oz. of gold.

**Foreign Companies**

Control of the Silesian-American Corporation is vested in Silesian Holding Company, of which Anaconda owns a majority of the shares. A dividend of 7 per cent on the preferred shares of Silesian-American Corporation was paid

during the year and the principal amount of its outstanding bonds was reduced to $12,429,000 by Dec. 31, 1928. The properties of its Polish subsidiary, Giesche Spolka Akcyjna, operated as satisfactorily throughout the year as the low zinc price of 5.467c. per pound, prevailing in European markets, permitted. The subsidiary companies produced approximately 133,467,000 lb. of zinc, 13,953,000 lb. of lead, 2,976,000 metric tons of coal, 103.590 tons of 60 deg. Bé. sulphuric acid, 67,360 tons of superphosphate and mixed fertilizers, and manufactured large quantities of zinc sheets, zinc battery cups, lead sheets, pipe, shot, litharge, brick, and sundry other products.

The greater part of the company's new construction and plant modernization was completed by Dec. 31, 1928, the new electrolytic zinc plant starting operations at the end of the year. Since acquisition of control by Anaconda, Giesche Spolka Akcyjna expended to Dec. 31, 1928, $7,604,132.54 for new construction, plant modernization, and mine development. Chile and Andes Copper are reviewed elsewhere.

Comparative financial statements of Anaconda Copper Mining Company follow:

| | 1928 | 1927 | 1926 | 1925 |
|---|---|---|---|---|
| Gross income | $291,199,087 | $246,682,861 | $272,845,362 | $263,415,956 |
| Operating expenses and taxes | 265,092,858 | 225,394,901 | 250,354,372 | 236,861,718 |
| Operating profit | $26,106,228 | $21,287,960 | $22,490,990 | $26,554,238 |
| Other income | 13,734,958 | 6,981,394 | 6,880,926 | 6,552,991 |
| Total income | $39,841,187 | $28,269,354 | $29,371,916 | $33,077,229 |
| Depreciation and obsolescence | 5,296,438 | 4,765,672 | 4,885,598 | 5,049,348 |
| Interest, and discount on bonds | 10,359,604 | 13,382,541 | 10,255,100 | 10,482,519 |
| Apportioned to minority interests | 10,363 | 2,117 | 5,016 | 4,830 |
| Net income | $24,174,780 | $10,123,258 | $14,226,202 | $17,540,532 |
| Dividends | 14,419,034 | 9,000,000 | 9,000,000 | 9,000,000 |

## London Financial News

By W. A. Doman
*Special London Correspondent*

London, May 21, 1929—The nitrate position has become distinctly interesting during the last few days, and people are beginning to wonder what is to be the outcome. There is more life in this market now than for a long time, and competition for nitrate grounds seems to be the order of the day. As I reported recently, the Guggenheims have acquired a large new territory from the Chilean government, and while the going is good the authorities are disposing of areas and are taking an even keener interest in affairs than before. To the state the nitrate industry is all important, and in some respects its attitude is a little unfair. At least, that is what one gathers from a perusal of the speech made by the chairman at the meeting of shareholders of the Nitrate Railways the other day. In disposing of new grounds, the government stipulates that the traffic in connection with them shall pass over the state line, although it could just as easily and cheaply be handled by the Nitrate Railways. The expenses of this line have risen substantially, and application has been made for certain concessions in respect of rates and carriage of materials for renewal of the system. The Nitrate Railways depends upon the nitrate industry, and, having served it well hitherto, naturally expects fair treatment. A well-known Chilean, Señor Don Santiago Sabioncello, is taking a very keen interest in nitrate, and has taken over the administration of the property and the sale of the production of the Compania Salitrera Aurrera, which owns oficinas Felisa, Nena Vilana, and San Remigio, all of which are producing nitrate. This, however, is only one of his activities, for he has also purchased the controlling interest in the Lagunas Nitrate Company, which owns oficina Central Lagunas, a producing concern. This is his second deal in a week, and, as showing his confidence in the Chilean government's willingness to give every assistance to the nitrate industry, he has also acquired the Santiago Nitrate Company's assets. This is a suggestion that some day he may dispose of his interests to the Guggenheims. The Tarapaca and Tocopilla Nitrate Company has agreed to purchase from the Grace Nitrate Company, of New York, a nitrate property in the Province of Tarapaca, extending to 19,154,490 square metres, and comprising plant and equipment in addition to stocks of iodine and stores, valued by the vendor company at £112,488. The consideration is 977,000 fully paid shares of 10s. each in the purchasing company. This issue is underwritten by the British & South Pacific Trading Company, and raises the capital to £1,000,000.

The Central Mining & Development Corporation last year earned a profit of £725,677, or almost the same as for 1927. Its interests are much less in mining undertakings than formerly, the holdings in gold, diamond, and platinum ventures being less than one-third of its share holdings, whereas the banking, railway, and industrial investments stand at a higher figure.

—◆—

Chief Consolidated Mining Company, operating in the Tintic district of Utah, sustained a net loss of $4,401 on operations in the first quarter of 1929.

Central Eureka mine, Sutter Creek, Calif., closed the fiscal year ended March 1 with a production record of $489,452, or $41,873 more than the preceding year. The company expended $51,426 for development work in the old Eureka mine and $23,894 in the Central Eureka and wound up with a cash balance of $136,398. The old Eureka shaft was unwatered to the 2,200 level and drifting on the vein started at level 2,100.

## STATISTICAL NOTES

California Copper Corporation has been granted permission to acquire another block of stock of the Engels Copper Mining Company by the California State Corporation Department. The permit was issued for the exchange of 8,337 shares of California Copper common stock for 83,370 shares of Engels stock. The California Copper Corporation was organized as a holding company for Engels Copper.

Michigan Iron Mines valuations recommended by Franklin Pardee, state appraiser of mines for 1929, total $90,303,000, compared with $93,597,000 for 1928. The reserves upon which these valuations were based were reduced from 173,653,533 tons to 169,430,407 tons. Last year 14,332,872 tons of iron ore were shipped out of the state. The reduction in reserves this year was 4,223,126 tons, leaving 10,109,746 tons, which as replaced by exploration and development operations. This reduction in reserves follows the general decline which has been recorded at these properties since 1921.

Dominion Explorers has recently raised a large sum of money through the issue of treasury stock. This is a private company in which the Lindsley group is interested, and all funds raised by the company to date have been privately subscribed. No public issue was made, and it is not intended to list the stock. The company is expanding its operations rapidly and now has a number of main bases and sub-bases throughout the North. In a recent 8,300-mile flight, Colonel MacAlpine, president of the company, placed over 100 prospectors at the various bases. Practically all supplies and men for operation in the Hudson Bay region have been moved in. The company has recently purchased a new plane and is completing the overhauling of the two planes used on the recent long flight.

Pacific Tidewater Mines shareholders will consider consolidation with Ladysmith Tidewater Smelters at an extraordinary meeting of the company. At the annual meeting, held recently in Victoria, Herbert Carmichael, managing director, stated that the directors believed such a consolidation would be to the interest of the company, as a considerable amount of overhead expense might be saved. He also stated that he had recently returned from England, where he had been authorized by British Metal to offer Pacific Tidewater shareholders one share in Ladysmith, a subsidiary of British Metal, for every ten shares of Pacific Tidewater. At present the smelting company shares have a par value of $5, but this will probably be changed to no par. Mr. Carmichael also stated that an electrical survey was being undertaken on the Gabbro group, adjoining the Sunloch mine, on Vancouver Island, and that probably a diamond-drilling campaign would follow.

## Mineral Production of British Columbia Increased in 1928

THE 1928 annual report of the Minister of Mines for British Columbia, recently released, gives the following table of the mineral production for that and the previous year.

The report was compiled by John D. Galloway, Provincial Mineralogist, and contains the usual information about the mining development of the province, well illustrated by reproductions of photographs, sketch-maps, and diagrams. All the important developments are described in detail.

The metal production was derived from 6,241,310 tons of ore, obtained from 110 mines, but, as in previous years, the bulk of the production came from a few large mines; thus, for example, the Sullivan mine was responsible for approximately 5,590,000 oz. of silver, 292,500,000 lb. of lead, and 167,842,000 lb. of zinc; the Britannia, Copper Mountain, and Hidden Creek mines produced 99 per cent of the total copper output, and the Premier mine accounted for about 125,000 oz. of gold and 2,100,000 oz. of the silver. With the exception of the Premier mine, all these mines either maintained or increased their ore reserves during the year; and more development was done on new properties and on old mines, which had been abandoned as worked out, than in any previous year, so the outlook for the future is decidedly bright.

Mr. Galloway estimated that the net value of the ore produced—that is, the value to the producer after the costs of freight, treatment, and marketing were paid—was $29,070,075, and the total amount disbursed in dividends by companies operating in the province was $11,556,688, or 17.7 per cent of the value of the production. Virtually all the dividends were from metal-mining operation.

During the year 15,424 men were employed in the mining and allied industries, of whom 8,280 were employed in metal mines, concentrators, and smelters.

| Description | 1927 Quantity | 1927 Value | 1928 Quantity | 1928 Value |
|---|---|---|---|---|
| Gold, placer, oz. | 9,191 | $156,246 | 8,424 | $143,208 |
| Gold, lode, oz. | 178,001 | 3,679,601 | 188,087 | 3,888,097 |
| Silver, oz. | 10,470,185 | 5,902,043 | 10,627,167 | 6,182,461 |
| Copper, lb. | 89,202,871 | 11,525,011 | 97,908,316 | 14,265,242 |
| Lead, lb. | 282,996,423 | 14,874,292 | 305,140,792 | 13,961,412 |
| Zinc, lb. | 145,225,143 | 8,996,135 | 181,763,147 | 9,984,613 |
| Coal, gross tons | 2,453,827 | 12,269,135 | 2,526,702 | 12,633,510 |
| Structual materials and miscellaneous minerals, value | ..... | 3,326,894 | ..... | 4,314,040 |
| Totals | ..... | $60,729,358 | ..... | $65,372,583 |

KENNECOTT COPPER CORPORATION has declared a quarterly dividend of $1.25 per share on common stock payable July 1 to stock of record May 31. This places the stock on a $5 annual basis, as against a $4 basis previously.

CAMBRO-KIRKLAND MINES, LTD. share holders have ratified the sale of the holdings of the company to the Bidgood Company. The price was announced as 1,000,000 shares of Bidgood stock. Merger of the two companies will give a length of about two miles along the strike of the known veins, as the properties are contiguous in the Kirkland Lake district of northern Ontario.

NEVADA CONSOLIDATED COPPER COMPANY reports the net production of copper from all sources for the first quarter of 1929, compared to that for the fourth quarter of 1928, as shown in the following tabulation:

| | Net Pounds Copper Produced | Average Monthly Production |
|---|---|---|
| First quarter—1929 | 78,381,399 | 26,127,133 |
| Fourth quarter—1928 | 81,226,417 | 27,075,473 |

Average recovery in the form of concentrates from all company material milled during the period was 84.84 per cent of the total copper contained therein, corresponding to 23.11 lb. of copper per ton treated, compared to a recovery of 86.35 per cent and 24.32 lb. per ton for the previous quarter.

Net cost per pound of copper produced, after crediting revenue from gold and silver and other miscellaneous earnings and income from subsidiaries, was 8.28c, compared with 7.58c for the fourth quarter of 1928. These costs include all operating and general charges of every kind except depreciation and reserve for federal taxes.

The financial results of the quarter's operations compare with those for the fourth quarter of 1928 as follows:

| | First Quarter 1929 | Fourth Quarter 1928 |
|---|---|---|
| Operating profit from copper production | $6,361,659 | $6,015,130 |
| Value of precious metals | 431,643 | 431,519 |
| Miscellaneous revenues, including income from subsidiaries | 364,782 | 496,033 |
| Total operating income | $7,158,084 | $6,942,683 |
| Depreciation | 433,565 | 415,864 |
| Net income | $6,724,519 | $6,526,819 |

A quarterly distribution to shareholders of 75c. per share was made March 30th.

ONTARIO BUREAU OF MINES in its quarterly report of gold production gives the following figures:

| | Tons Milled | First Quarter of 1929: Recovery per Ton Milled |
|---|---|---|
| Teck-Hughes | 81,650 | $15.26 |
| Lake Shore | 98,016 | 14.59 |
| Sylvanite | 17,904 | 10.00 |
| Vipond | 25,640 | 7.90 |
| McIntyre | 137,940 | 7.89 |
| Dome | 136,700 | 7.57 |
| Wright-Hargreaves | 60,361 | 7.45 |
| Kirkland Lake Gold | 12,942 | 6.04 |
| Hollinger | 365,651 | 5.71 |
| Coniaurum | 24,800 | 5.56 |
| Barry-Hollinger | 4,223 | 5.24 |
| Ankerite | 10,301 | 5.13 |
| March Gold | 10,355 | 5.09 |
| West Dome | 8,003 | 4.15 |

## Minerais et Metaux Expands Scope of Operations

BY DR. JAMES RUBINFELD
*Special Berlin Correspondent*

THE French Société Minerais et Metaux, which was founded during the World War by the Penarroya, Boleo, Vieille Montagne, Asturienne des Mines, Pontigibaud, and others, with the object of replacing the Metallgesellschaft in the treatment of French and Belgian ores and in the metal trade generally, has expanded largely since its inception, horizontally as well as vertically, by acquiring many producing companies. Its flotation plant at Ganges, Herault, is said to be operating satisfactorily; at Balaida-Karaidin, Turkey, a similar plant is being erected. Minerais et Metaux is largely interested in the Mediterranéenne pour le Traitement des Minerais et la Metallurgique d'Hoboken, Francaise d'Affinage de Cuivre et Metaux rares, Francaise des Mines de Maroc, Société Minière, and Metallurgique et Chimique de l'Orb. The latter has started operating its flotation plant.

It is reported that the French Société de Rochetrejou has received permission to mine antimony ores in the arondissement de Confolens within an area of 132 hectares. The Indochinese companies, Etains et Wolfram du Tonkin, Etain de L'Indochine, and Etain du Cammon, have decided to co-operate in working the tin-ore fields of Laos.

The French company Le Nickel, that controls the nickel mines in New Caledonia, is about to increase its capital in order to secure the wherewithal for further extensions on that island. Its subsidiary Le Chrome is to run the electrolytic plant at Yaté.

The Exploitations Minières, of Tunis, which has sold the Coley process rights of the N. C. Metal to the likewise English concern, Zinc Manufacturing Company, reports that the latter is about to extend the Coley process to tin-ore treatment and that a special syndicate has been formed for this purpose.

The North African company Société de Zinc de Guergour, owner of several galena mines in the department of Constantine, notwithstanding its continued strong financial condition, is reported to suffer much—as is true also of the other North African mine undertakings such as Exploitations Minières, Mokta-el-Hadid and Djebel Djerissa—because of the great scarcity of labor. A remedy has not yet been found by a representative group of industrial leaders who have studied the problem, largely because France, and particularly Paris, continues to attract a goodly proportion of the available labor

The Bulgarian goverment has decided to substitute for its banknotes of face value from 5 to 10 lewas coins to be made largely from nickel. The 20, 50, and 100 lewa notes are to be replaced by silver coins of 69 per cent silver content. Thus another country introduces nickel into its monetary system.

# The Market Report

## Non-Ferrous Metal Markets Unchanged

*New York, June 5, 1929.*—Virtually no change is discernible in the non-ferrous metal markets of the last week. Sentiment seems, in general, to be much better, and the general consensus of opinion is that major buying movements in most of the more important metals certainly will develop this month.

### Copper Continues at 18c.

A slight improvement in foreign demand has resulted from the virtual settlement of the reparations question, and the consequent increase in buying from abroad, in which England has been a dominant factor, has tended to improve sentiment in the trade here. A further bullish item has been the strength of copper shares on the stock exchanges, which is taken to indicate that Wall Street believes present prices will be maintained.

The domestic market continues of a desultory character, with the custom smelters taking all the business and the primary producers remaining out of the market. Copper Exporters, Inc., maintains its c.i.f. price at 18.30c. per pound, usual European destinations.

### Lead Unchanged

Most sellers have done a somewhat improved business in lead in the week ending today, but the market cannot be said to have been active. Prices in the East are unchanged, at the 7c., New York basis, which is also the contract price of the American Smelting & Refining Company. In the Middle West, the large sellers are on a 6.80c., St. Louis, basis, but sales of prompt metal at 6.75c. have been sufficient to warrant consideration of that price in reporting the market. Both chemical and desilverized lead in the Middle West have been sold at the lower quotation basis. At least two lots of July lead have been sold, but most of the inquiry is for prompt shipment for a diversity of uses. There is now considerably less feeling that there may be a weakening in the price structure than there was a couple of weeks ago, and June sales are likely to be much better than those of April and May. Corroding grades command the usual $2@$3 per ton premium.

### Zinc Very Quiet

Sales of zinc have been almost negligible in the last week. A slightly larger tonnage was reported at the 6.80c. price of the primary producers, and a lesser tonnage changed hands at the lower or "open market" prices

### Average Metal Prices for May, 1929

| | |
|---|---|
| COPPER: | |
| New York Electrolytic | 17.775 |
| London Standard Spot | 75.026 |
| London Electrolytic Spot | 83.727 |
| LEAD: | |
| New York | 7.000 |
| St. Louis | 6.761 |
| London Spot | 23.949 |
| London Forward | 23.750 |
| SILVER: | |
| New York | 54.125 |
| London | 25.084 |
| Sterling Exchange | 484.599 |
| ZINC: | |
| St. Louis | 6.618 |
| London Spot | 26.727 |
| London Forward | 26.619 |
| TIN: | |
| Straits | 43.904 |
| London | 197.545 |
| QUICKSILVER | 121.154 |
| ANTIMONY | 8.957 |
| PLATINUM: | |
| Refined | 68.615 |
| Crude | 58.615 |
| ALUMINUM 99 Per Cent Plus | 24.300 |

### Daily Prices of Metals

| May June | Electrolytic Copper | Straits Tin | Lead | | Zinc |
|---|---|---|---|---|---|
| | Refinery | New York | New York | St. Louis | St. Louis |
| 30 | Holiday | ..... | .... | ..... | ..... |
| 31 | 17.775 | 43 375 | 7.00 | 6.75@6.80 | 6.625 |
| 1 | 17.775 | 43 375 | 7.00 | 6.75@6.80 | 6.60@6.80 |
| 3 | 17.775 | 43 875 | 7.00 | 6.75@6.80 | 6.55@6.80 |
| 4 | 17.775 | 43 75 | 7.00 | 6.75@6.80 | 6.55@6.80 |
| 5 | 17 775 | 43.50 | 7.00 | 6.75@6.80 | 6.60@6.80 |
| | 17 775 | 43.575 | 7.000 | 6.775 | 6.675 |

Average prices for calendar week ending June 1, 1929, are: Copper, 17.775; Straits tin, 43.425; N. Y. lead, 7.000; St. Louis lead, 6.790; zinc, 6.640; and silver, 53.100.

**The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.**

**Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.**

**In the trade, copper prices usually are quoted on a delivered basis; that is delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.**

**Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.**

**Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.**

**Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.**

### London

| May June | Copper | | | Tin | | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|
| | Standard | | Electrolytic | | | | | | |
| | Spot | 3M | | Spot | 3M | Spot | 3M | Spot | 3M |
| 30 | 73 7/16 | 72 5/8 | 83 1/2 | 196 3/8 | 199 1/8 | 23 9/16 | 23 1/2 | 26 1/4 | 26 3/8 |
| 31 | 73 5/8 | 73 | 83 1/2 | 196 1/4 | 199 | 23 9/16 | 23 1/2 | 26 1/16 | 26 3/8 |
| 3 | 73 1/8 | 72 3/4 | 84 | 197 5/8 | 200 3/8 | 23 1/2 | 23 1/2 | 26 1/2 | 26 3/8 |
| 4 | 73 7/8 | 73 5/8 | 84 1/4 | 198 3/4 | 201 1/2 | 23 3/4 | 23 5/8 | 26 1/2 | 26 3/8 |
| 5 | 73 15/16 | 73 5/8 | 84 1/4 | 197 1/2 | 200 3/8 | 23 3/4 | 23 11/16 | 26 7/16 | 26 1/4 |

**The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.**

### Silver, Gold, and Sterling Exchange

| May June | Sterling Exchange "Checks" | Silver | | Gold London | June | Sterling Exchange "Checks" | Silver | | Gold London |
|---|---|---|---|---|---|---|---|---|---|
| | | New York | London | | | | New York | London | |
| 30 | Holiday | ..... | 24 1/8 | 84s11 1/2d | 3 | 4.84 3/8 | 52 1/4 | 24 3/16 | 84s11 1/2d |
| 31 | 4.84 7/16 | 52 1/4 | 24 9/16 | 84s11 1/2d | 4 | 4.84 3/8 | 51 3/8 | 24 | 84s11d |
| 1 | 4.84 3/8 | 52 3/8 | 24 3/8 | ..... | 5 | 4.84 7/16 | 52 1/8 | 24 | 84s11 1/2 |

Average: Silver 52.325c.; Sterling Exchange, 484.400c.

**New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.**

maintained by two sellers of custom zinc. The result has been that the weighted average price for the week shows a marked appreciation over the prices reported in preceding weeks, despite the fact that for all practical purposes the zinc market is unchanged.

## No Interest in Tin

Neither traders nor consumers have taken any interest in tin this week, so that the volume of sales and the price range have both been small. The week's quotations have varied between 43⅜ and 43¾c. for prompt, with about ⅛c. premium on futures.

## Silver Closes Steadier

The silver market has continued to share a tendency of weakness caused by lack of support, and a new low since October, 1926, 51⅛c., was quoted in New York on June 4. The market has since shown some improvement, and prices have reacted sharply to 52⅛c. in New York as a result of a reversal of China conditions and a better demand from India. The undertone is steady.

*Mexican Dollars* (Old Mexican pesos): May 30th, holiday; 31st, 40⅛c.; June 1st, 39⅞c.; 3d, 39⅝c.; 4th, 39¼c.; 5th, 39½c.

## Foreign Exchange

Closing cable quotations on Tuesday, June 4, were as follows: Francs, 3.90⅛c.; lire, 5.23¼c.; and marks, 23.84¾c. Canadian dollars, ⅛ per cent discount.

## Tri-State Concentrate Prices Unchanged

*Joplin, Mo., June 1, 1929*

**Blende**

| | Per Ton |
|---|---|
| High | $46.20 |
| Premium blende, basis 60 per cent zinc | $44.00@ 45.00 |
| Prime Western, basis 60 per cent zinc | 43.00@ 44.00 |
| Table concentrates, 60 per cent zinc | 41.00@ 43.00 |
| Flotation concentrates, 60 per cent zinc | 39.00@ 41.00 |
| Average settling price, all zinc concentrates | 44.11 |

**Galena**

| | |
|---|---|
| High | $92.30 |
| Basis 80 per cent lead | 90.00 |
| Average settling price, all lead concentrates | 91.01 |

Shipments for the week: Blende 10,620 tons; lead 1,415 tons. Value all concentrate the week, $597,230.

There is no change to report in the basis price of either zinc or lead concentrate. The market has been desultory, and buying and selling has been of an easy nature. Each week brings some new move in option-taking, and the air is full of "merger" rumors. A new company that took over a group of mines last winter, and began gathering options on other properties, has closed several, and will close others this month. At two mines in one group of options, thought to be close to depletion, drill prospects are promising the developments of rich reserves in adjoining ground and lower levels of the old ground.

*Platteville, Wis., June 1, 1929*

| Zinc Blende | Per Ton |
|---|---|
| Blende, basis 60 per cent zinc | $46.75 |

| Lead Ore | |
|---|---|
| Lead, basis 80 per cent | $90.00 |

Shipments for the week: Blende, 578 tons; lead, none. Shipments for the year: Blende, 14,689; lead, 760 tons. Shipments for the week to separating plants, 1,198 tons blende.

## Steel Production Appears Likely to Taper Off Gradually

*Pittsburgh, June 4, 1929*

Steel demand did not begin to taper off until about the middle of May, fully two months later than the average date of the familiar seasonal decrease. The most marked decrease is in buying by the automobile industry, which has been taking about 23 per cent of all the steel made since Jan. 1, against not over 18 per cent last year and smaller proportions in previous years.

In at least half the finished-steel lines there has been quite an accumulation of actual shipping orders on mill books, in some instances representing six weeks or more of production. This gives the industry much momentum, except for the point that some consumers may have ordered with extra liberality.

PIG IRON.—Valley prices as marked up 50c. per ton late in April have been obtained, at $19 for bessemer and malleable and $18.50 for basic and foundry, but the market is very dull, and consumers show little confidence in these prices. All pig-iron markets are dull, and Southern iron, which has declined $1.50 since early March to $15, Birmingham, is trying to penetrate farther north.

CONNELLSVILLE COKE.—The market has been very dull. Spot furnace coke remains at $2.75@$2.85, and spot foundry is slightly easier at $4@$4.25.

## Other Metals

**Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.**

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. London, 98 per cent, quoted at £95 per long ton, less 2 per cent for domestic consumption.

ANTIMONY—Per lb., duty paid: Chinese brands, for all positions, 8⅞c. Cookson's "C" grade, spot, 14c. Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c. Nominal.

BISMUTH—Per lb., in ton lots, $1.70. Smaller lots $1.85 and up. London 7s. 6d.

CADMIUM—Per lb., 85@95c. Active. London, 4s. 2d.@4s. 3d. for prompt. Contract prices are slightly lower.

CHROMIUM — Per lb., 97 per cent grade, $1.50.

COBALT — Per lb., f.o.b. Canadian works: Shot or rondelles, 96@98 per cent, $2.50. Black oxide, 70 per cent, $2.10. London, 10s. for metal in small lots, 8s. for black oxide; 8s. 10d. for gray.

[1]GERMANIUM OXIDE—Per gram in 300- to 500-gram lots, $3.50.

IRIDIUM—Per oz., $230@$240 for 98 @99 per cent sponge and powder. London, £52@£55.

[1]LITHIUM—Per oz., 98@99 per cent grade in 1- to 5-lb. lots, $5.

MAGNESIUM—Per lb., in ton lots, single orders for spot metal: 8-lb. ingots (3x3x15 or 16 in.), 85c.@$1.05, depending on quantity; 2½- or 3-lb. sticks (1⅜ in.), $0.90@$1.10, depending on quantity; 10-oz. sticks (1x12 in.), 85@90c. Discounts up to 20 per cent on larger orders or contracts. London 3s. 3d.@3s. 9d. for 99 per cent ingots or sticks.

[1]MOLYBDENUM—Per lb. in 1- to 3-lb. lots, 99 per cent, $18. (Usually sold as calcium molybdate or ferromolybdenum, which see).

NICKEL—Per lb., ingot 35c.; shot 36c.; electrolytic, 35c. (99.90 per cent), for single lots of spot metal. London, per long ton, £170@£175 according to quantity.

OSMIUM—Per oz., $58@$65; London, £12@£14.

PALLADIUM — Per oz., $38@$40. London, £7 5s.@£8 5s.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $68. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less.

London, per oz., £13 10s.@£13 15s. for refined; crude and scrap, nominal at £11 10s.@£12.

QUICKSILVER—Per 76-lb. flask, $120 @$121. Small lots command usual premiums. San Francisco wires $123 for retail and small wholesale lots. London quiet, with offers of spot at £22 2½s.@ £22 5s.

RADIUM—Per mg. radium content, $70.

RHODIUM—Per oz., $45@55. Nominal. London, £9 10s.@£11.

RUTHENIUM — Per oz., $45@$55. Nominal. London, £9@£10 10s.

[1]SELENIUM — Per lb. in ton lots: Black, powdered, amorphous, 99.5 per cent pure, $2.25. London, 7s. 8d.@ 7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure 16c.; tantalum powder, 11c. Market strong.

TELLURIUM—Per oz., 15@18c.

THALLIUM METAL—$12.50@$15 per pound.

TITANIUM—Per lb., 80@90 per cent grade, $5.

TUNGSTEN POWDER—Containing 97 to 98 per cent tungsten, per lb., $1.35@ $1.50, depending on quantity. Nominal.

VANADIUM—Per gram, 92@95 per cent grade, $1.25.

[1]ZIRCONIUM METAL—Per oz., 98 per cent grade, $1.56 in 5- to 10-lb. lots.

[1]Price furnished by Foote Mineral Co., Philadelphia.

## Metallic Ores

ANTIMONY ORE—Bolivian ore, 60 per cent metallic antimony, $1.35 per short ton unit, c.i.f. New York.

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian and Rhodesian ores, $22 for 47 per cent $Cr_2O_3$ ore to $24.50 for 50@51 per cent ore. New Caledonian ore, high-grade, $25.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores:

Mesabi, non-bessemer, 51½ per cent iron, $4.50. Old Range, non-bessemer, $4.50.

Mesabi, bessemer, 51½ per cent iron, $4.65. Old Range, bessemer, 51½ per cent, $4.80.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 56 to 63 per cent, 8c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

North African, low-phosphorus, 11½ @11¾c.

Spanish and North African basic, 50@60 per cent, 10@11c. Nominal.

Swedish foundry or basic, 66@68 per cent, 9@10c.

Newfoundland foundry, 55 per cent, 8½@9c.

MANGANESE ORE—Per long-ton unit of Mn, c.i.f. North Atlantic ports. Exclusive of duty. Brazilian and Indian ores, minimum 47 per cent Mn, 30@32c. Caucasian (washed), 53@55 per cent, 36@38c.

Per ton in carload lots:

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent $MnO_2$. Brazilian and Cuban, $70@$80. Caucasian, minimum 85 per cent, $70. Montana, 70 to 75 per cent, $70@$80. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of $Ta_2O_5$, basis 60 per cent ore, $13.

TITANIUM ORE—Ilmenite, per gross ton, 50 per cent $TiO_2$, f.o.b. Atlantic seaboard, $9.50@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., guaranteed minimum 94 per cent concentrate, 10c. in carload lots.

TUNGSTEN ORE—Per short-ton unit of $WO_3$, N. Y.: Wolframite, $15.50@$18. Western scheelite, $16.50, nominal.

VANADIUM ORE—Per lb. $V_2O_5$ contained, 28c.

ZIRCON ORE—Per net ton containing 55 per cent $ZrO_2$, f.o.b. Atlantic seaboard, $40@$45 in 30-ton lots.

## Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]AMBLYGONITE—Per ton, f.o.b. mines: 8@9 per cent lithium oxide, $50@$60.

[1]Price given by Foote Mineral Co., Philadelphia.

ASBESTOS — Per ton: f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest for delivery on 1929 contract:

Crude No. 1, $550@$750; crude No. 2, $450@$575; spinning fibers, $225@$275; magnesia and compressed sheet fibers, $175@$225; shingle stock, $55@$115, various grades; paper stock, $45@$50; cement stock, $25; short fibers, $10@$20; floats, $12@$15. Europe reports a general shortage of Canadian spinning fiber and No. 2 crude.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per ton: f.o.b. mines, bags extra:

*Georgia:* Barytes ore, crude (per long ton), $6.50. Washed and water floated to 97 per cent through 300 mesh, $19. Slight lessening in demand reported.

*Missouri:* Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $7.25@$7.50. f.o.b. mines.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent $Al_2O_3$, 1.5 to 2.5 per cent $Fe_2O_3$, $7.50@$8.25 f.o.b. *Alabama* and *Arkansas* mines. Other grades, 56 to 59 per cent $Al_2O_3$, 5 to 8 per cent $SiO_2$, $6.75@$8.25 f.o.b. *Arkansas* mines. Pulverized and dried, $12@$14 f.o.b. *Arkansas* mines; calcined, 78 to 84 per cent $Al_2O_3$, $18@$20 f.o.b. *Arkansas* mines.

Per metric ton, foreign, c.i.f. Atlantic port: Dalmatian, 50 to 55 per cent $Al_2O_3$, 1 to 3 per cent $SiO_2$, $4.50@$6.50; Istrian, 54 to 57 per cent $Al_2O_3$, 3 to 5 per cent $SiO_2$, $5.50@$7; French, 56 to 59 per cent $Al_2O_3$, 2 to 5 per cent $SiO_2$, $6@$8.

BORAX—Per lb.: Carload lots, in bags, crystals, 2¾c.; granulated or powdered, 2½c.; f.o.b. consumers' shipping point.

[1]CELESTITE—Per ton in carload lots: 90 per cent $SrSO_4$, finely powdered, $27.

CHALK—Per ton: Crude in bulk, c.i.f. *New York,* $4.75@$5.

CHINA CLAY (KAOLIN)—Per ton: F.o.b. *Virginia* mines, crude lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $8@$15; ground. $7@$15.

*Florida,* pressed pottery, bulk, $13; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour in 100-lb. bags (bags extra), No. 1, $20; No. 2, $17.

Best grade, domestic, $16@$18, f.o.b. *Delaware* plants in carload lots.

Imported English, f.o.b. American ports: Lump, $13@$21; powdered, $40@$45.

DIATOMITE—Per short ton, f.o.b. producing plant:

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $25; natural aggregate, ¼ in., $18@$20; air-floated powder, $45; 80 to 85 per cent silica, 98 per cent through 200 mesh, $20 in carload lots.

EMERY—F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 6½c.; domestic, 3½c.

FELDSPAR—F.o.b. mine or grinding plant:

*North Carolina,* per long ton, No. 1 pottery grade, crude, $6.50@$7.50; glass grades, $5@$6.

No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 20 mesh, $10.25; 90 mesh, $12; 140 mesh, $13.75; 200 mesh, $15.50. No. 3, 20 mesh, $9.

*New Hampshire,* per ton: Pottery grade, $8. Best quality lump, $9.

*New York,* per ton: f.o.b. cars, No. 1 crude, $9. Soda feldspar, 140 mesh, first grade, $18 per short ton; 200 mesh, first grade, $20 per short ton. Market dull.

*Maine,* per ton: Best pottery grade, ground, $19.

FLUORSPAR — Per ton: F.o.b. *Kentucky* and *Illinois* mines:

Gravel, not less than 85 per cent $CaF_2$, and not over 5 per cent $SiO_2$, $18. Foundry lump, 85-5, $20. Ground, 95 to 98 per cent $CaF_2$, and not over 2½ per cent $SiO_2$, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $32.50 in car lots. Market quiet but firm.

*New Mexico:* 85-5 gravel, $16.50; 85-5 lump, $17; 94-3 lump, $21; 96-3, 100-mesh, $30.

Foreign spar, duty paid, $19.40, tidewater.

FULLER'S EARTH — Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 16 to 60 mesh, $17; 60 to 90 mesh, $14; 100 mesh up, $7.

Powdered, import duty paid, $24@$25 per ton.

GARNET—Per ton; domestic, f.o.b. mines, $85.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE — Per ton, carload lots, f.o.b. mines *Colorado.*

Selected grade, $33; seconds (mine run), $25.50. Normal market.

GRAPHITE—Per lb., f.o.b. *New York:* Ceylon lump, 7½@9c.; chip, 6½@7½c.; dust, 3@5½c.; Madagascar flake, 6½@8½c. Market fair.

No. 1 flake, 10c. and up. No. 2 flake, 6c. and up. Foundry facings, 3c. and up. Graphite facings, 4c. and up. Amorphous and crystalline, fine ground, 8c. and up.

Crude amorphous graphite, $15@$35 per ton, according to grade. Market unchanged.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade, in carload lots, $20.

GYPSUM—Per ton, f.o.b. mill, depending upon location: Crushed, $1.70@$6; ground, $4@$9; agricultural, $4@$9; calcined, $4@$13.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 3@4½c.; domestic earth, 2@4½c.

KAOLIN—See China Clay.

[1]LEPIDOLITE—Per ton: $20@$30 for ordinary grades. Nominal.

LIMESTONE—Per ton: f.o.b. shipping points, depending on location, either lump or crushed, 25c.@$3.

Agricultural, 40c. up to $5 for crushed or pulverized. Prices depend upon source, purity, and fineness.

MAGNESITE — Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $43; Grade B, $40; dead burned, $29; crude, $11. *Washington:* Dead-burned magnesite, $22@$24 per net ton, Chewelah, Wash.

MICA—Per ton, f.o.b. plant:

*New Hampshire:* Mine run, $250; clean shop scrap, $25; roofing, $25. White dry ground, 20 mesh, $28; 40 mesh, $38; 60 mesh, white, $55; off-color, $34; 100 mesh, $70; 200 mesh, $80. Granite mica facings for cement block and stucco use, $8@$12, depending on size between ¼ in. and 60 mesh.

*North Carolina:* White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, per lb., f.o.b. *New York*, duty paid: No. A1, $2.50; No. 1, $2; No. 2, $1.65; No. 3, $1.15; No. 4, 60c.; No. 5, 45c.

[1]MONAZITE—Per ton: (Minimum 6 per cent $ThO_2$), $80.

OCHER — F.o.b. *Georgia* mines, per ton: $19@$20 in sacks; $21@$22 in barrels; washed and water floated, $18; second grade, 99 per cent through 225 mesh, $18.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

*Florida*, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10. Prices firm.

*Florida*, pebble, domestic: 76@77 per cent, $6.50; 74@75 per cent, $5.50; 72 per cent, $4.50; 70 per cent, $4.

*Tennessee*, ground, 90 per cent through 200 mesh, 33 per cent $P_2O_5$, $11.20 per short ton. Brown lump for acid manufacture, per gross ton, $6 on 75 per cent basis; $5.25 on 72 per cent basis. Non-acidulated, fine ground, 65 per cent, $8 (per short ton).

POTASH—The ruling contract prices are as follows:

| | Bags | Bulk |
|---|---|---|
| Muriate of potash 80 @ 85 per cent, basis 80 per cent | 36.40 | 34.80 |
| Sulphate of potash 90 @ 95 per cent, basis 90 per cent | 47.30 | 45.70 |
| Sulphate of potash-magnesia 48 @ 53 per cent, basis 48 per cent | 27.25 | 25.65 |
| Manure salt 30 per cent | 21.75 | 18.75 |
| Manure salt 20 per cent | 15.40 | 12.40 |
| Kainit 14 @ 16 per cent | 12.50 | 9.50 |
| Kainit, 12.4 per cent | 12.00 | 9.00 |

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

PUMICE STONE—Per lb.: In barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur: C.i.f. United States ports; guaranteed 48 per cent sulphur: Spanish, 13c.; Tharsis, furnace size, 2½ in. diameter, 14c. Cinder from ore to remain property of buyers.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots: Colorless, clear but flawed, pieces ¼ to ½ lb. in weight, 20c. For optical purposes, four times above price; larger crystals still higher.

SILICA—Per ton: Water ground and floated, in bags, f.o.b. Illinois: 400 mesh, $31; 350 mesh, $26; 250 mesh, $18. Market fair. Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35@$3.50.

[1]SPODUMENE — Per ton: $20@$30, depending upon lithium content.

SULPHUR—Per long ton for domestic market, $18 f.o.b. Texas mines; $22 for export, Atlantic ports. Prices in reality are on a c.i.f. basis, but the average price reduced to an f.a.s. figure is about as given. Open prices $1 to $3 higher than above.

TALC—Per ton, carload lots, f.o.b. works, containers included:

*Vermont:* 99 per cent through 200 mesh, extra white, $9@$9.50; 97½ to 98½ per cent through 200 mesh, medium white, $8.50@$9; packed in 50-lb. paper bags; prices $1 per ton less in burlap sacks plus 15c. net for bags packed 12 to the ton.

*New York:* Double air-floated, short fiber, 200 mesh, $13.75; 325 mesh, $14.75.

*Georgia:* Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9.

*New Jersey:* Soapstone, ground, $10@$12.

TRIPOLI—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh, rose and cream colored, $16. Double ground through 110 mesh, rose and cream, $18. Air-floated through 200 mesh, rose and cream, $27.50; mill run, $16.

## Metallic Compounds

ANTIMONY OXIDE—White, Chinese. 99 per cent $Sb_2O_3$, 14½c. per lb. Nominal.

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c.; delivered near by. Market firm. London, per long ton, £16@£16½ quoted for Cornish white: Mexican high grade, £17, c.i.f. Liverpool.

CALCIUM MOLYBDATE OR MOLYTE — Per lb. of contained Mo, 95c., delivered.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 6c., for either large or small crystals.

SODIUM NITRATE—Per 100 lb.; crude natural, in bags ex vessel, Atlantic ports, $2.22½ for May and June deliveries.

SODIUM SULPHATE (Salt Cake)—Per ton, bags, f.o.b. works, $20; in barrels, $24@$33.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6⅝c.; French red seal, in bags, 9⅛c.

## Alloys

[1]FERROCERIUM—Per lb., $8 in 15 to 75 lb. lots.

FERROCHROME—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 11c. on requirement contracts; spot shipments about ½c. per pound higher. Freight allowed on carload lots east of Mississippi River and north of Baltimore. Market active.

FERROMANGANESE — Per gross ton furnace: Domestic and foreign, 78@82 per cent, $105. Spiegeleisen, 19@21 per cent, $33@$34 on carload business, f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.20.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee*.

FERROSILICON—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River and north of Baltimore: 50 per cent, $83.50; 75 per cent, $130; 15@17 per cent, $45, f.o.b. Suspension Bridge, N. Y. Quotations for spot shipments $5@$10 per ton higher on 50 and 75 per cent grades.

FERROCARBONTITANIUM — Per ton: $160, f.o.b. producer's plant.

FERROTUNGSTEN—Per lb. of W contained, 75œ80 per cent W, $1.35œ$1.45 f.o.b. works. Market quiet but strong.

FERROVANADIUM—Per lb. of V contained, f.o.b. works, freight allowed. $3.15@$3.50, depending on grade and quantity. Market active.

NICKEL SILVER—Per lb. for 18 per cent nickel Grade A sheets, 34¼c.

YELLOW (MUNTZ) METAL—Dimension sheets, per lb., 25c.; rods per lb., 22¼.

## Rolled Metals

COPPER—Sheets, hot-rolled, per lb., 27¾c.; wire, per lb., f.o.b. mill, 19⅞c.

LEAD SHEETS—Full rolled, 11c. per lb.; clipped, 11¼c.

MONEL METAL—Per lb., sheets, full finished, 42c.; rods, hot-rolled, 35c.

NICKEL—Per lb., sheets, full finished, 52c.; rods, hot-rolled, 45c.

ZINC SHEETS—Per lb., 10¼c., f.o.b. works.

## Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$46, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35@$38.

MAGNESITE—Brick, per net ton, f.o.b. works: 9-in. straights, $65. Cement, $40, seaboard.

SILICA BRICK—Per M., *Pennsylvania* and *Ohio*, $43; *Alabama*, $51; *Illinois*, $52.

ZIRKITE—Per lb.; Powdered, 65@70 per cent $ZrO_2$, 3½c. Brick, straights, 80c.@$1 each.

[1]Price furnished by Foote Mineral Co., Philadelphia.

# Metal Statistics

## Monthly Average Prices of Metals

### Silver

| | New York | | London Spot | | Sterling Exchange | |
|---|---|---|---|---|---|---|
| | 1928 | 1929 | 1928 | 1929 | 1928 | 1929 |
| January | 57.135 | 57.019 | 26.313 | 26.257 | 487.098 | 484.577 |
| February | 57.016 | 56.210 | 26.205 | 25.904 | 487.008 | 484.787 |
| March | 57.245 | 56.346 | 26.329 | 26.000 | 487.558 | 484.776 |
| April | 57.395 | 55.668 | 26.409 | 25.738 | 487.785 | 484.808 |
| May | 60.298 | 54.125 | 27.654 | 25.084 | 487.685 | 484.599 |
| June | 60.019 | ..... | 27.459 | ..... | 487.565 | ..... |
| July | 59.215 | ..... | 27.262 | ..... | 485.923 | ..... |
| August | 58.880 | ..... | 27.096 | ..... | 484.979 | ..... |
| September | 57.536 | ..... | 26.440 | ..... | 484.654 | ..... |
| October | 58.087 | ..... | 26.727 | ..... | 484.584 | ..... |
| November | 57.953 | ..... | 26.704 | ..... | 484.492 | ..... |
| December | 57.335 | ..... | 26.349 | ..... | 484.698 | ..... |
| Year | 58.176 | ..... | 26.746 | ..... | 486.169 | ..... |

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

### Copper

| | New York | | London Spot | | | |
|---|---|---|---|---|---|---|
| | Electrolytic | | Standard | | Electrolytic | |
| | 1928 | 1929 | 1928 | 1929 | 1928 | 1929 |
| January | 13.854 | 16.603 | 61.912 | 75.551 | 66.575 | 78.602 |
| February | 13.823 | 17.727 | 61.670 | 78.228 | 66.381 | 83.538 |
| March | 13.845 | 21.257 | 61.148 | 89.153 | 66.443 | 98.356 |
| April | 13.986 | 19.500 | 61.678 | 81.036 | 66.500 | 89.405 |
| May | 14.203 | 17.775 | 62.554 | 75.026 | 67.216 | 83.727 |
| June | 14.527 | ..... | 63.664 | ..... | 68.738 | ..... |
| July | 14.527 | ..... | 62.881 | ..... | 68.670 | ..... |
| August | 14.526 | ..... | 62.472 | ..... | 68.750 | ..... |
| September | 14.724 | ..... | 63.522 | ..... | 69.800 | ..... |
| October | 15.202 | ..... | 65.524 | ..... | 71.935 | ..... |
| November | 15.778 | ..... | 68.080 | ..... | 74.750 | ..... |
| December | 15.844 | ..... | 69.336 | ..... | 75.000 | ..... |
| Year | 14.570 | ..... | 63.703 | ..... | 69.230 | ..... |

New York quotations, cents per pound London, pounds sterling per long ton.

### Lead

| | New York | | St. Louis | | London | | | |
|---|---|---|---|---|---|---|---|---|
| | 1928 | 1929 | 1928 | 1929 | 1928 Spot | 1928 3 Mos. | 1929 Spot | 1929 3 Mos. |
| January | 6.500 | 6.650 | 6.280 | 6.498 | 21.773 | 22.213 | 22.111 | 22.344 |
| February | 6.329 | 6.853 | 6.069 | 6.739 | 20.283 | 20.747 | 23.128 | 23.156 |
| March | 6.000 | 7.450 | 5.805 | 7.348 | 19.938 | 20.352 | 25.409 | 25.591 |
| April | 6.100 | 7.187 | 5.991 | 7.025 | 20.306 | 20.563 | 24.783 | 24.408 |
| May | 6.123 | 7.000 | 6.012 | 6.761 | 20.483 | 20.813 | 23.949 | 23.750 |
| June | 6.300 | ..... | 6.152 | ..... | 20.985 | 21.211 | ..... | ..... |
| July | 6.220 | ..... | 6.038 | ..... | 20.602 | 20.957 | ..... | ..... |
| August | 6.248 | ..... | 6.056 | ..... | 21.634 | 21.628 | ..... | ..... |
| September | 6.450 | ..... | 6.286 | ..... | 22.050 | 21.769 | ..... | ..... |
| October | 6.500 | ..... | 6.318 | ..... | 22.082 | 21.796 | ..... | ..... |
| November | 6.389 | ..... | 6.222 | ..... | 21.239 | 21.469 | ..... | ..... |
| December | 6.495 | ..... | 6.343 | ..... | 21.342 | 21.730 | ..... | ..... |
| Year | 6.305 | ..... | 6.131 | ..... | 21.060 | 21.271 | ..... | ..... |

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

### Tin

| | New York | | London | |
|---|---|---|---|---|
| | 1928 | 1929 | 1928 | 1929 |
| | Straits | | Spot | |
| January | 55.650 | 49.139 | 253.222 | 222.727 |
| February | 52.440 | 49.347 | 233.833 | 223.138 |
| March | 52.220 | 48.870 | 232.722 | 220.781 |
| April | 52.270 | 45.858 | 234.204 | 206.887 |
| May | 51.582 | 43.904 | 230.886 | 197.545 |
| June | 47.938 | ..... | 217.280 | ..... |
| July | 47.040 | ..... | 212.449 | ..... |
| August | 48.012 | ..... | 212.847 | ..... |
| September | 48.073 | ..... | 215.663 | ..... |
| October | 48.966 | ..... | 222.005 | ..... |
| November | 50.750 | ..... | 232.875 | ..... |
| December | 50.185 | ..... | 227.586 | ..... |
| Year | 50.427 | ..... | 227.131 | ..... |

New York quotations, cents per pound. London, pounds sterling per long ton.

### Zinc

| | St. Louis | | London | | | |
|---|---|---|---|---|---|---|
| | 1928 | 1929 | 1928 Spot | 1928 3 Mos. | 1929 Spot | 1929 3 Mos. |
| January | 5.643 | 6.350 | 26.125 | 26.051 | 26.196 | 26.233 |
| February | 5.551 | 6.350 | 25.518 | 25.506 | 26.247 | 26.347 |
| March | 5.624 | 6.463 | 25.082 | 24.960 | 27.050 | 27.294 |
| April | 5.759 | 6.658 | 25.493 | 25.316 | 26.759 | 26.613 |
| May | 6.026 | 6.618 | 26.102 | 25.756 | 26.727 | 26.619 |
| June | 6.158 | ..... | 25.664 | 25.429 | ..... | ..... |
| July | 6.201 | ..... | 24.946 | 24.972 | ..... | ..... |
| August | 6.249 | ..... | 24.540 | 24.713 | ..... | ..... |
| September | 6.250 | ..... | 24.497 | 24.625 | ..... | ..... |
| October | 6.250 | ..... | 24.030 | 24.296 | ..... | ..... |
| November | 6.263 | ..... | 24.801 | 24.827 | ..... | ..... |
| December | 6.349 | ..... | 26.609 | 26.615 | ..... | ..... |
| Year | 6.027 | ..... | 25.284 | 25.256 | ..... | ..... |

St. Louis quotations, cents per pound. London pounds sterling per long ton.

## Antimony, Quicksilver and Platinum

| | Antimony (a) | | Quicksilver (b) | | Platinum (c) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Refined | | Crude | |
| | New York | | New York | | New York | | | |
| | 1928 | 1929 | 1928 | 1929 | 1928 | 1929 | 1928 | 1929 |
| Jan. | 10.863 | 9.558 | 123.620 | 119.481 | 79.280 | 70.000 | 69.280 | 60.000 |
| Feb. | 10.842 | 9.548 | 121.370 | 119.818 | 84.783 | 70.000 | 74.783 | 60.000 |
| March | 10.083 | 9.531 | 122.557 | 121.904 | 80.000 | 70.000 | 70.000 | 60.000 |
| April | 9.865 | 9.462 | 123.740 | 122.000 | 80.000 | 70.000 | 70.000 | 60.000 |
| May | 11.019 | 8.957 | 123.173 | 121.154 | 78.000 | 68.615 | 68.000 | 58.615 |
| June | 9.750 | ..... | 122.423 | ..... | 78.000 | ..... | 68.000 | ..... |
| July | 9.540 | ..... | 121.260 | ..... | 78.000 | ..... | 68.000 | ..... |
| Aug. | 10.181 | ..... | 124.500 | ..... | 78.000 | ..... | 68.000 | ..... |
| Sept. | 10.813 | ..... | 128.000 | ..... | 78.000 | ..... | 68.000 | ..... |
| Oct. | 10.841 | ..... | 125.923 | ..... | 78.000 | ..... | 68.000 | ..... |
| Nov. | 10.109 | ..... | 123.000 | ..... | 76.417 | ..... | 66.418 | ..... |
| Dec. | 9.748 | ..... | 122.500 | ..... | 74.480 | ..... | 64.480 | ..... |
| Year | 10.305 | ..... | 123.506 | ..... | 78.580 | ..... | 68.580 | ..... |

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce.

## Pig Iron[1] and Aluminum

| | Bessemer | | Basic | | No. 2 Foundry | | Aluminum | |
|---|---|---|---|---|---|---|---|---|
| | 1928 | 1929 | 1928 | 1929 | 1928 | 1929 | 1928 | 1929 |
| Jan. | 17.50 | 18.00 | 17.00 | 17.50 | 17.25 | 17.50 | 24.300 | 24.300 |
| Feb. | 17.50 | 18.00 | 17.00 | 17.50 | 17.25 | 17.50 | 24.300 | 24.300 |
| March | 17.50 | 18.19 | 17.00 | 17.62 | 17.25 | 17.69 | 24.300 | 24.300 |
| April | 17.50 | 18.50 | 17.00 | 18.00 | 17.25 | 18.00 | 24.300 | 24.300 |
| May | 17.37 | 18.81 | 16.38 | 18.31 | 17.24 | 18.31 | 24.300 | 24.300 |
| June | 17.00 | ..... | 15.56 | ..... | 16.79 | ..... | 24.300 | ..... |
| July | 17.00 | ..... | 15.75 | ..... | 16.69 | ..... | 24.300 | ..... |
| Aug. | 17.00 | ..... | 15.75 | ..... | 16.50 | ..... | 24.300 | ..... |
| Sept. | 17.00 | ..... | 15.75 | ..... | 16.50 | ..... | 24.300 | ..... |
| Oct. | 17.24 | ..... | 16.66 | ..... | 16.74 | ..... | 24.300 | ..... |
| Nov. | 17.82 | ..... | 17.32 | ..... | 17.32 | ..... | 24.300 | ..... |
| Dec. | 18.00 | ..... | 17.50 | ..... | 17.50 | ..... | 24.300 | ..... |
| Year | 17.37 | ..... | 16.66 | ..... | 17.02 | ..... | 24.300 | ..... |

Iron in dollars per long ton. Aluminum in cents per pound, 99 per cent grade.

[1]F.o.b. Mahoning and Shenango valley furnaces; freight to Pittsburgh, $1.76.

## Monthly Crude Copper Output in Short Tons

| | 1928 | | | 1929 | | | |
|---|---|---|---|---|---|---|---|
| | Nov. | Dec. | Total | Jan. | Feb. | Mar. | April |
| **Domestic** | | | | | | | |
| Alaska shipments | 1,313 | 1,807 | 22,724 | 2,145 | 913 | 1,974 | 2,075 |
| Calumet & Arizona | 6,346 | 7,033 | 65,182 | 5,254 | 5,553 | 5,888 | 6,041 |
| Magma | 1,635 | 1,436 | 18,251 | 1,730 | 1,450 | 1,680 | 1,780 |
| Miami | 2,119 | 2,148 | 24,129 | 2,262 | 2,157 | 2,620 | 2,591 |
| Nevada Con. | ..... | †40,613 | 134,231 | ..... | ..... | †39,191 | ..... |
| Old Dominion* | 943 | 804 | 11,069 | 921 | 734 | 1,015 | 1,040 |
| Phelps Dodge†† | 9,080 | 10,361 | 102,137 | 9,850 | 9,537 | 10,524 | 10,230 |
| United Verde Extens. | 2,133 | 2,344 | 22,073 | 2,338 | 2,024 | 2,504 | 2,682 |
| Utah Copper | ..... | †42,956 | 136,920 | ..... | ..... | †40,500 | ..... |
| Tennessee Copper | 639 | 558 | 6,792 | 597 | 616 | 635 | 619 |
| **Foreign** | | | | | | | |
| Andes Copper | 7,835 | 6,890 | 52,029 | 7,485 | 7,000 | 8,300 | ..... |
| Braden | 10,438 | 4,740 | 109,137 | 6,510 | 4,830 | 9,375 | ..... |
| Boleo, Mexico | ..... | †3,422 | 12,782 | ..... | ..... | †2,910 | ..... |
| Bwana M'Kubwa | 533 | 649 | 6,696 | 812 | 605 | 686 | 615 |
| Chile | 14,080 | 15,380 | 132,932 | 15,645 | 15,085 | 16,720 | ..... |
| Furukawa, Japan | 1,396 | 1,468 | 17,865 | 1,420 | 1,473 | 1,751 | ..... |
| Granby Cons., Canada | 2,359 | 2,465 | 28,767 | 2,677 | 2,324 | 2,452 | 2,631 |
| Howe Sound | ..... | †5,490 | 21,099 | ..... | ..... | †5,157 | ..... |
| Sumitomo, Japan | 1,562 | 1,660 | 17,898 | 1,502 | 1,335 | 1,680 | ..... |
| Union Miniere, Africa | 10,174 | 9,440 | 123,880 | 9,753 | 9,477 | 11,820 | 12,810 |

†Three months. *Includes Arizona Commercial.
††Moctezuma is included.

## Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

| | 1927 | | 1928 | | 1929 | |
|---|---|---|---|---|---|---|
| | Monthly Production | Daily Rate | Monthly Production | Daily Rate | Monthly Production | Daily Rate |
| January | 76,198 | 2,458 | 68,469 | 2,209 | 86,325 | 2,785 |
| February | 69,202 | 2,472 | 67,423 | 2,352 | 84,735 | 3,026 |
| March | 69,314 | 2,236 | 70,327 | 2,269 | 93,698 | 3,023 |
| April | 71,122 | 2,371 | 69,721 | 2,324 | 94,085 | 3,136 |
| May | 71,613 | 2,310 | 73,729 | 2,378 | ..... | ..... |
| June | 69,539 | 2,318 | 73,224 | 2,441 | ..... | ..... |
| July | 65,545 | 2,114 | 73,426 | 2,369 | ..... | ..... |
| August | 67,248 | 2,169 | 76,952 | 2,482 | ..... | ..... |
| September | 65,936 | 2,198 | 78,341 | 2,611 | ..... | ..... |
| October | 68,545 | 2,225 | 86,480 | 2,790 | ..... | ..... |
| November | 68,080 | 2,269 | 85,382 | 2,846 | ..... | ..... |
| December | 67,377 | 2,173 | 85,673 | 2,764 | ..... | ..... |
| Total | 829,878 | ..... | 909,147 | ..... | 358,843 | ..... |
| Monthly average | 69,165 | ..... | 75,762 | ..... | 89,711 | ..... |
| Average of daily rate | ..... | 2,274 | ..... | 2,484 | ..... | 2,990 |

# Mining Stocks—Week Ended June 1, 1929

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **COPPER** | | | | | | |
| Anaconda | New York | 105⅛ | 99½ | 103⅛ | Mr.29,My.20 Q | 1.75 |
| Andes Copper | New York | 48⅞ | 44⅛ | 47½ | Mr.29, My.6 Q | 0.75 |
| Arizona Com | Boston | 3½ | 2⅛ | 2⅛ | Ja. 16, Ja. 31 S.A. | 0.25 |
| Calumet & Ariz | New York | 130½ | 124½ | 126 | My.31, Je.17 Q | 2.50 |
| Calumet & Hecla | Boston | 40⅜ | 37 | 39⅜ | My.31, Je.29 Q | 1.00 |
| Cerro de Pasco | New York | 92⅛ | 88⅛ | 91 | Ap.11, My. 1 Q | 1.50 |
| Chile Copper | New York | 86⅛ | 86⅛ | 86⅛ | Je. 1, Je.28 Q | 0.87½ |
| Con. Coppermines | N. Y. Curb | 11 | 9⅛ | 10 | | |
| Copper Range | Boston | 21 | 20 | 20⅜ | Mr.15, Ap.15 Q | 0.50 |
| East Butte | Boston | 3½ | 2⅛ | 2⅛ | Dec., 1919 | 0.50 |
| Granby Con | New York | 70 | 62½ | 68⅜ | Ap.12, My.1 Q | 1.75 |
| Greene Cananea | New York | 143½ | 136½ | 140 | Je. 6, Jl. 1 Q | 2.00 |
| Howe Sound | New York | 60 | 56½ | 58 | Mr. 30, Ap. 15 Q | 1.00 |
| Hudson Bay | N. Y. Curb | 17½ | 16½ | 16⅞ | | |
| Inspiration | New York | 42⅞ | 38½ | 41⅛ | Je.13, Jl. 1 Q | 1.00 |
| Isle Royale | Boston | 21 | 20 | 20 | My. 31, Je.29 | 0.50 |
| Kennecott | New York | 83⅛ | 77 | 81½ | My. 31, Jl. 1 Q | 1.25 |
| Magma Copper | New York | 65⅛ | 60 | 65 | Mr.30, Ap.16 Q | 1.25 |
| Mason Valley | N. Y. Curb | 1¼ | 1⅛ | 1⅛ | | |
| Miami Copper | New York | 39 | 35 | 38½ | My1, My15 Q | 1.00 |
| Mohawk | Boston | 55 | 52½ | 54 | Ap. 30, Je. 1 Q | 1.50 |
| Mother Lode | New York | 3½ | 3 | 3⅛ | De.14, De.31 SA | 0.20 |
| Nevada Con | New York | 44½ | 40 | 43½ | Mr.15, Mr.30 Q | 0.75 |
| New Cornelia | N. Y. Curb | ... | ... | 47½ | Fe. 1, Fe. 18 Q | 0.50 |
| Noranda | N. Y. Curb | 51⅛ | 48½ | 49½ | | |
| Ohio Copper | N. Y. Curb | 2 | 1⅛ | 1⅛ | Sept., 1926 | 0.03 |
| Old Dominion | Boston | 10½ | 9⅛ | 10 | Dec., 1918 | 1.00 |
| Phelps Dodge, new | N. Y. Curb | ... | ... | 79½ | Je. 4, Jl. 1 Q | 0.75 |
| Quincy | Boston | 36½ | 32 | 35½ | March, 1920 | 1.00 |
| Roan Antelope | N. Y. Curb | 45⅛ | 43⅛ | 45⅛ | | |
| St. Mary's M. L. | Boston | 32⅛ | 31 | 31 | Fe.25, Mr.12 | 2.00 |
| Seneca Copper | New York | 5⅛ | 4 | 5 | | |
| Shattuck Denn | N. Y. Curb | 18 | 16½ | 16½ | | |
| Sherritt-Gordon | Toronto | 7.50 | 7.00 | 7.10 | | |
| Tenn. C. & C. | New York | 17⅞ | 16½ | 17 | My.31, Je.15 Q | 1.25 |
| United Verde Ex | N. Y. Curb | 18½ | 17½ | 18 | Ap. 4, My. 1 Q | 1.00 |
| Utah Copper | New York | 300 | 295 | 295 | Mr. 15, Mr. 30 Q | 3.00 |
| Waite-Ack.-Mont | Toronto | 4.25 | 4.00 | 4.00 | | |
| Walker Mining | Salt Lake | ... | ... | 3.80 | | |
| Wenden Copper | N. Y. Curb | 1⅛ | 1⅛ | 1⅛ | | |
| **LEAD, ZINC, SILVER** | | | | | | |
| Ahumada Lead | New York | 2⅛ | 2 | 2⅛ | | |
| Amer. Z. L. & S. | New York | 29 | 24½ | 25⅝ | May, 1917 | 1.00 |
| A. Z. L. & S., pfd. | New York | 99 | 99 | 99 | Je.14, Jl. 1 | 1.50 |
| Bingham Mines | Boston | 52 | 52 | 52 | Mr.15, Ap.5 | 0.50 |
| Bunker Hill & S. | N. Y. Curb | 145 | 145 | 145 | Ap.25, My.6 X | 0.75 |
| Butte Cop. & Zn. | New York | 5⅞ | 4⅛ | 5 | | |
| Butte Cop. Con. | Boston Curb | *51 | *35 | *38 | | |
| Butte & Sup. | New York | ... | ... | 7 | Mr. 15, Mr. 30 Q | 0.50 |
| Callahan Zn-Ld. | New York | 2 | 1⅛ | 1⅛ | Dec., 1920 | 0.50 |
| Chief Consol. | Salt Lake | ... | ... | 3 10 | Fe. 1, 1928 K | 0.10 |
| Consol. Ld. & Zn. "A" | St. Louis | 13½ | 13 | 13½ | Ap.5, Ap.10 | 0.25 |
| Constitution | Spokane | *37½ | *36½ | *37½ | | |
| Davrock | Spokane | 2.75 | 2.50 | 2.50 | Je.20, Je.30 | 0.03 |
| Dickens Consol. | Spokane | *5½ | *5½ | *5½ | | |
| Eagle-Picher | Cincinnati | 17 | 16½ | 16½ | Mr.31, Ap.15 Q | 0.20 |
| Eagle-Pich., pfd. | Cincinnati | ... | ... | 102 | Jan. 15 Q | 1.50 |
| Erupcion | Boston Curb | ... | ... | *13 | Ja. 1, 1928 Q | 0.07½ |
| Eureka Bullion | Salt Lake | ... | ... | *97 | | |
| Eureka Lilly | Salt Lake | ... | ... | 1 42½ | | |
| Eureka Standard | Salt Lake | ... | ... | 3.32½ | | |
| Evans-Wallower | N. Y. Curb | 17½ | 16½ | 17 | | |
| Evans-Wal., pfd. | N. Y. Curb | 84½ | 84½ | 84½ | Mr.20, Ap.1 Q | 1.75 |
| Federal M. & S. | New York | 230 | 215 | 217 | Je., 1927 | 10.00 |
| Fed. M. & S., pfd | New York | 99½ | 99 | 99½ | My.24, Je.15 Q | 1.75 |
| Gladstone | Spokane | *11 | *11 | *11 | | |
| Golconda | Spokane | 1.41 | 1.37 | 1.39 | Je.15, Jl.1 | 0.02 |
| Grandview | Spokane | *36½ | *34 | *34 | | |
| Hecla Mining | N. Y. Curb | 17⅛ | 17⅛ | 17⅞ | My.15, Je.15 Q | 0.25 |
| Highland-Surprise | Spokane | *14⅜ | *14⅜ | *14⅜ | | |
| Jack Waite | Spokane | *10⅛ | *10 | *10⅛ | | |
| Kootenay Florence | Spokane | *12⅜ | *12⅛ | *12⅛ | | |
| Lucky Jim | Spokane | *12⅛ | *12 | *12 | | |
| Lucky Tiger-C. | Kansas City | †5.00 | †3.75 | ... | De.4, De.20 MX | 0.12 |
| Mexican Premier | Spokane | 2.30 | 2.03 | 2.15 | | |
| National Lead | New York | 143 | 142 | 142 | Je. 14, Je. 29 Q | 1.25 |
| Natl. Lead, pfd. A | New York | 140⅛ | 140 | 140 | Mr. 1, Mr. 15 Q | 1.75 |
| Natl. Lead, pfd. B | New York | 118 | 118 | 118 | My. 19, Au 1 Q | 1.50 |
| N. J. Zinc, new | N. Y. Curb | 80⅛ | 78 | 80⅛ | Je.1, Je.14 X | 0.50 |
| New Quincy | Salt Lake | ... | ... | 2.40 | My.15, My.27 Q | 0.10 |
| Noble Five | Spokane | *58 | *55 | *58 | | |
| North Lily | Salt Lake | .... | .... | 8.25 | Jan. 20 Q | 0.25 |
| Park Bingham | Salt Lake | ... | ... | 6.75 | | |
| Park Utah | New York | 8⅛ | 7⅛ | 7⅞ | Mr. 19, Ap. 10 Q | 0.20 |
| Pend Oreille | Spokane | 5.00 | 5.00 | 5.00 | | |
| Rico Argentine | Salt Lake | ... | ... | *31 | No. 30, De. 15 Q | 0.03 |
| Ruth-Hope | Spokane | *34 | *30 | *30 | | |
| St. Joseph Lead | New York | 70⅛ | 64 | 67⅛ | Ju. 8, Ju.20 QX | 0.75 |
| Sherman Lead | Spokane | *34 | *31 | *31 | | |
| Silver King Con. | Salt Lake | ... | ... | 13⅜ | Mr. 20, Ap. 1 Q, | 0.25 |
| Silversmith | Spokane | *15 | *14 | *14⅜ | Oct., 1926 Q | 0.02 |
| Sunshine Mining | Spokane | 2.36 | 2.30 | 2.30 | De. 20, BM | 0.02 |
| Tamarack-Custer | Spokane | *52½ | *48 | *52½ | Sept., 1924 | 0.25 |
| Tintic Standard | Salt Lake | ... | ... | 14 | De. 23, Ja. 23 X | 0.20 |
| Tonopah Belmont | N. Y. Curb | *56½ | *56 | *56½ | Oct., 1925 | 0.05 |
| Treadwell-Yukon | Toronto | 11.50 | 10.50 | 10.50 | | |
| United Zinc Smg. | N. Y. Curb | *75 | *62½ | *62½ | | |
| Utah Apex | Boston | 3⅜ | 3⅛ | 3⅜ | May 15, June 1 | 0.25 |
| Utah Met. & Tun. | Boston | 1⅜ | *90 | *95 | Dec., 1917 | 0.30 |
| Whitewater | Spokane | *70 | *70 | *70 | | |
| Yellow Pine | Los Angeles | .. | .... | *8 | Dec., 1925 QX | 0.04 |
| **GOLD** | | | | | | |
| Alaska Juneau | New York | 5⅛ | 4⅞ | 4⅞ | | |
| Barry-Hollinger | Toronto | *30 | *25 | *25 | | |
| Central Manitoba | Toronto | *43 | *40 | *40 | | |
| Coniaurum | Toronto | ... | ... | *45 | | |
| Cresson Consol. | N. Y. Curb | *75 | *68½ | *68½ | Mr.30, Ap.10 Q | 0.02 |
| Dome Mines | New York | 9⅛ | 9⅛ | 9⅛ | Mr.30, Ap.20 Q | 0.25 |
| Golden Cycle | Col. Springs | †1.85 | †1.82 | .... | Fe.15, Mr.1 | 0.04 |
| Gold Hill | Toronto | *3⅛ | *3 | *3 | | |
| Hollinger | Toronto | 6.00 | 5.70 | 5.70 | My.31, Je.17 M | 0.05 |
| Homestake | New York | 76⅛ | 76 | 76 | My.20, My.25 M | 0.50 |
| Kirkland Lake | Toronto, | *92 | *80 | *85 | | |
| Lake Shore | Toronto | 24.50 | 22.00 | 22.00 | Je.1, Je.15 Q | 0.20 |
| McIntyre-Pore | New York | 16⅛ | 16 | 16⅛ | My.1, Je.1 Q | 0.25 |
| Portland | Colo.Springs | †*11⅛ | †*10⅛ | .... | April, 1927 | 0.02 |
| Rand Mines | New York | 35 | 35 | 35 | Fe. 21,'28 Am.Sh. | 1.52 |
| Siscoe | Toronto | *70 | *50 | *58½ | | |
| Sylvanite | Toronto | 1.49 | 1.19 | 1.25 | | |
| Teck-Hughes | Toronto | 8.70 | 8.05 | 8.05 | Ap. 7,My 1, O | 0.15 |
| Tom Reed | Los Angeles | *25 | *25 | *25 | Dec., 1926 | 0.02 |
| Unity Gold | N. Y. Curb | 1⅛ | 1⅛ | 1⅛ | | |
| Vipond Consol | Toronto | *94 | *80 | *85 | April, 1927 | 0.03 |
| Wright-Hargreaves | Toronto | 1.50 | 1.35 | 1.36 | Oc. 16, No. 1 | 0.02½ |
| Yukon-Alaska | N. Y. Curb | .... | .... | 35⅛ | | |
| **GOLD AND SILVER** | | | | | | |
| Carnegie Metals | N. Y. Curb | 17⅛ | 16 | 16⅞ | | |
| Castle-Trethewey | Toronto | *33 | *32 | *33 | | |
| Consol. Cortez | N. Y. Curb | ... | ... | *18⅛ | | |
| Dolores Esperanza | N. Y. Curb | *93½ | *75 | *93½ | July, 1923 | 0.05 |
| Keeley | Toronto | *52 | *45 | *52 | Mr.15, 1928 | 0.04 |
| Mining Corp. | Toronto | 4.25 | 3.75 | 3.80 | My 30, Je.13 | 0.12½ |
| Montana-Idaho | Spokane | *11⅛ | *10⅛ | *10⅞ | | |
| N. Y. & Hond. Ros. | N. Y. Curb | ... | ... | 17½ | Ap.17,Ap.27 QX | 0.05 |
| Nipissing | N. Y. Curb | 2⅛ | 2⅛ | 2⅛ | Mr.30,Ap.20 Q | 0.07½ |
| Premier Gold | N. Y. Curb | 1⅛ | 1⅛ | 1⅛ | Mr.14, Ap.4 | 0.06 |
| Tonopah Exten | N. Y. Curb | ... | ... | *10 | April, 1925 | 0.05 |
| Tonopah Mining | N. Y. Curb | 3⅛ | 3⅛ | 3⅛ | Ap. 7, Ap. 20 | 0.07½ |
| United Eastern | N. Y. Curb | *68⅛ | *25 | *25 | | |
| Yukon Gold | N. Y. Curb | *62⅛ | *56⅛ | *62⅛ | June, 1918 | 0.02 |
| **IRON AND STEEL** | | | | | | |
| Bethlehem Steel | New York | 98 | 93 | 95⅞ | Jl.19, Au.15 Q | 1.00 |
| Beth. Steel, pfd, 7% | New York | 119⅛ | 116⅛ | 117⅞ | Je.1, Jl.1 Q | 1.75 |
| Cleveland-Cliffs | Cleveland | 230 | 180 | 200 | Ap.15, Ap.25 Q | 1.00 |
| Colo. Fuel & Iron | New York | 59⅛ | 56 | 57⅛ | | |
| Colo. F. & I., 1st pfd. | New York | ... | ... | 78 | My.10,My.25 Q | 2.00 |
| Great Northern Iron. | New York | 27⅛ | 25⅛ | 26 | Dec.15, K | 2.00 |
| Inland Steel | New York | 87⅛ | 85⅛ | 87 | My.15, Jn. 1, Q | 0.87½ |
| Republic I. & S. | New York | 91⅛ | 86⅛ | 90 | My. 11, Je. 1, Q | 1.00 |
| Republic I. & S., pfd. | New York | 111⅛ | 111½ | 111½ | Je.12, Jl. 1, Q | 1.75 |
| Sloss-Sheffield S. & I. | New York | 65 | 60⅛ | 62 | Mr. 11, Mr.20, Q | 1.50 |
| Sloss-Sheff. S. & I., pfd. | New York | ... | ... | 106 | Je.20, Jl.1, Q | 1.75 |
| U. S. Steel | New York | 167⅛ | 162⅛ | 165 | | |
| U. S. Steel, new | New York | 167⅛ | 163 | 165⅛ | | |
| U. S. Steel, pfd. | New York | 142 | 141 | 141 | My. 4,My 29, Q | 1.75 |
| Virginia I. C. & C. | New York | ... | ... | 2⅛ | Jan., 1924 | 1.50 |
| Virginia I.C.& C., pfd. | New York | 46 | 45 | 45 | Jl.16, 1928 | SA 2.50 |
| **MISCELLANEOUS** | | | | | | |
| Aluminum Co. of Am. | N. Y. Curb | 270 | 252 | 260 | | |
| Alum.Co.of Amer., pf. | N. Y. Curb | 108⅛ | 108⅛ | 108⅛ | Mr.15, Ap.1, Q | 1.50 |
| American Metal | New York | 55⅛ | 50 | 55⅛ | My.9, Je. 1 Q | 0.75 |
| Amer. Metal, pfd., 6% | New York | 114⅛ | 114⅛ | 114⅛ | My.21, Je.1, Q | 1.50 |
| Amer. Sm. & Ref. | New York | 98⅛ | 94 | 96⅛ | Ap.12, My.14 Q | 1.00 |
| Amer & Sm. Ref., pfd. | New York | 134½ | 130 | 130 | My. 3, Ju. 1 Q | 1.75 |
| Ang. Ch. Nitrate | N. Y. Curb | 39⅛ | 38 | 38⅛ | | |
| Asbestos Corp. | Montreal | 12 | 11 | 11⅞ | Jan. 1926 | 1.50 |
| Asbestos Corp., pfd. | Montreal | 40 | 39½ | 39½ | De. 31, Ja. 15 Q | 1.75 |
| Consol. M. & S. | Montreal | 390 | 370 | 378 | De.31,Ja.15,SAX | 6.25 |
| De Beers Consol. | New York | ... | ... | 23 | Ja. 19, Ja.26, | 0.48 |
| Federated Metals | N. Y. Curb | 31 | 29 | 29 | Mr.27, Ap.5 Q | 0.75 |
| Freeport Texas | New York | 41⅛ | 38⅛ | 39 | Ap. 5, My. 1 Q | 1.00 |
| Int. Nickel Can. | New York | 47⅛ | 44 | 45⅛ | Je.1, Je.29 Q | 0.20 |
| Int. Nickel, pfd. | New York | ... | ... | 121 | Ap.2,My.1No.1Q | 1.75 |
| Newmont | N. Y. Curb | 200 | 190⅛ | 195 | Mr.30, Ap.15 Q | 1.00 |
| Patiño M. & E. | New York | 37⅛ | 34⅛ | 34⅛ | My. 31, Jn. 28 | 4a |
| So. America G. & P. | N. Y. Curb | 2⅛ | 2⅛ | 2⅛ | | |
| Texas Gulf Sulphur | New York | 73⅞ | 70⅛ | 71⅛ | Je.1, Je.15 Q | 1.00 |
| U. S. Sm. R. & M. | New York | 54⅛ | 48 | 53⅛ | Ap. 4, Ap. 15 Q | 0.87½ |
| U. S. Sm. R. & M., pfd. | New York | 53⅛ | 52⅛ | 53⅛ | Ap. 4, Ap. 15 Q | 0.87½ |
| Vanadium Corp. | New York | 83⅛ | 68 | 71½ | Fe.1, Fe. 15 Q | 0.75 |

Toronto Standard Stock Exchange, Toronto, courtesy Arthur E. Moysey & Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I, Initial. R, Resumption. X, Extra. The first data given is that of the closing of the books; the second that of the payment of the dividend.

## LONDON QUOTATIONS—WEEK ENDED MAY 21, 1929

| | High | Low | Last | Date | Amount |
|---|---|---|---|---|---|
| Alaska Mexican ($5) | 20/— | 20/— | 20/— | | |
| Alaska Treadwell (25) | 67/6 | 66/10½ | 67/3 | Nov., 1926 | 4 p.c.(d) |
| Aramayo Mines (25 frs.) | 61/— | 58/9 | 60/— | May 1929 | 5 p.c.(†) |
| Burma Corp (10 rupees) | 17/10½ | 17/3 | 17/7½ | Feb., 1929 | 7 annas* |
| Bwana M'Kubwa (5s) | 17/9 | 16/9 | 17/3 | | |
| Camp Bird (2s) | 2/3 | 1/10½ | 2/3 | April, 1928 | 16⅔ p.c. |
| El Oro (£1) | 5/1½ | 4/7½ | 5/— | Nov., 1924 | 2½ p.c.* |
| Frontino & Bolivia (£) | 8/9 | 8/7½ | 8/9 | Jan., 1929 | 3½ p.c. |
| International Nickel of Canada (Quoted in dollars with a fixed rate of $5 to the £1) (no par value) | $54⅜ | $50⅛ | $50⅛ | Mar., 1929 | 20(c) |
| Mexican Corpn. (£1) | 14/3 | 13/3 | 13/9 | | |
| Mexican Mines of El Oro (£1) | 6/3 | 4/9 | 5/— | Dec., 1926 | 3¾ p.c.* |
| Mount Isa (£) | 47/3 | 46/3 | 46/10½ | | |
| N'Changa Copper Mining (£1) | 70/7½ | 66/10½ | 68/9 | | |
| Oroville Dredging (4s) | 1/10½ | 1/9 | 1/10½ | Nov., 1928 | 31½ p.c. |
| Rhodesian Congo Border (£1) | 130/— | 113/1½ | 130/— | | |
| St. John del Rey (£1) | 18/1½ | 17/7½ | 17/9 | Apr., 1929 | 7½ p.c. |
| San Francisco Mines (10s) | 36/7½ | 36/4½ | 36/6 | Jan., 1929 | 25 p.c. |
| Santa Gertrudis (£1) | 10/10½ | 10/6 | 10/9 | Jan, 1929 | 7½ p.c. |
| Selukwe (2s. 6d.) | 5/7½ | 5/1½ | 5/6 | April, 1917 | 6¼ p.c. |
| S. Amer. Copper (2s.) | 2/6 | 2/— | 2/4½ | Nov. 1917 | 75 p.c. |
| Tanganyika (£1) | 60/7½ | 58/9 | 60/— | July, 1928 | 5 p.c. |
| Union Miniere de Haut-Katanga (Brussels) | 11,900 | 11,850 | 11,860 | April, 1929 | 300.00 fr. |

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian francs and free of taxation. (d) U. S. Dollars.